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PROTECTION OF OCEANS, ALL KINDS OF SEAS INCLUDING ENCLOSED AND SEMI-ENCLOSED SEAS, COASTAL AREAS AND THE PROTECTION, RATIONAL USE AND DEVELOPMENT OF THEIR LIVING RESOURCES

BACKGROUND DOCUMENT

Report of the Secretary-General of the Conference

I. INTRODUCTION

1. Decision 1/20 of the Preparatory Committee of the United Nations Conference on Environment and Development requested the Secretary General of the Conference to submit a comprehensive report with recommendations for action covering 20 substantive issues. In accordance with document A/CONF.151/PC/30 and decision 2/18 of the Preparatory Committee at its second session, the issues were regrouped into 6 components which are summarized in this report.

(a) Coastal Development and Enclosed Seas
(b) Management of Living Marine Resources
(c) Marine Pollution Prevention and Control Strategies
(d) Implications of Climate Change in Ocean Management
(e) Capacity Building
(f) Legal Instruments and International Institutions

2. Each of these areas was covered by a lead United Nations Agency with the very valuable support of the Office for Oceans Affairs and the Law of the Sea of the United Nations Secretariat, the United Nations Environment Programme, the Food and Agriculture Organization of the United Nations, the International

Maritime Organization, the Intergovernmental Oceanographic Commission, the International Atomic Energy Agency, the World Meteorological Organization, the United Nations Centre for Human Settlements and the World Health Organization. Non-governmental organizations also contributed including: the Oslo and Paris Commissions, the World Resources Institute, the International Union for Conservation of Nature, the International Council of Scientific Unions, the Environmental Defense Fund, Greenpeace International, Friends of the Earth, and the International Indigenous Commission.

3. Additional reports were requested of the Secretary-General which are presented separately:

i. Global Ocean Observing System prepared by IOC, WMO and UNEP (Document A/CONF.151/PC/70).
ii. Land Based Sources of Pollution (Document A/CONF.151/PC/71):
- Report of the Intergovernmental Expert Meeting held in Halifax, Canada (6-10 May)
- Evaluation of the Montreal Guidelines by UNEP
- Proposals for further cooperation by UNEP

iii. Environmental Assessment of the Gulf Crisis prepared by UNEP and IMO (Document A/CONF.151/PC/72).

4. The Preparatory Committee requested the Secretary General to take due account in its further work in this area of the relevant paragraphs of the Bergen Ministerial Declaration on Sustainable Development in the ECE Region, the Tlatelolco Platform on Environment and Development, the Ministerial Declaration on Environmentally Sound and Sustainable Development in Asia and the Pacific and the Regional Conference for Africa organized in accordance with General Assembly resolution 44/228, Section II, para. 13 and decision I of the Preparatory Committee at its organizational session.

5. These reports together with the background papers were used in preparing this background synthesis. This paper includes a framework for an integrated approach to marine and coastal sustainable development. The main elements for a programme of action are presented in Document A/CONF.151/PC/42/Add.6 entitled Oceans: Options for Agenda 21.

6. It would therefore be useful to recall the results of the regional conferences, highlighting the points that are most relevant for the ocean issues. Some of the proposals have been considered in this report and in the Options for Agenda 21:

(i) The Bergen Declaration, highlights the importance of achieving sustainable patterns of production and consumption, of applying the "precautionary principle", of integrating environmental considerations with economic and sectoral planning, of making extensive use of economic instruments with balanced mix of regulatory approaches, of increasing the flow of capital and environmentally sound technology to developing countries, of addressing the relationship between population pressures and sustainable development, and of analyzing the inter-linkages between environmental and trade policies. Special reference is made to sustainable energy use, to sustainable industrial activities with relevant recommendations for ocean and coastal management.

(ii) The Tlatelolco Platform highlights the need to pay special attention to poverty and social equity, economic crisis, international trade access to technology, funding mechanisms and the importance of considering the peculiarities and vulnerability derived from the size of small island States. In relation to protection and management of oceans, seas and coastal zones several important proposals are mentioned in order to optimize the benefits from the use of the region's resources for its development. Some of the proposals include the following: prepare inventories of the resources, establish "special areas" for protection purposes, exchange of data, improve appropriate technology, increase links between regional bodies, establish regional marine technology centres, promote integrated management of coastal areas, ban the discharge of toxic wastes into the oceans, create cooperation mechanisms and promote an international agreement on land-based sources of marine pollution.

(iii) The Ministerial Declaration on Environmentally Sound and Sustainable Development in Asia and the Pacific stresses the adoption of an integrated approach to environment and development with special reference to poverty, health and population, the adoption of the precautionary principle and transfer of technology, and the elaboration of a regional strategy on environmentally sound and sustainable development including the special problems of small islands. Calls for promoting environmental education, exchange of information, technical assistance and cooperation.

(iv) The results of the Regional Conference for Africa were not available at the time of writing this report.

II. PROBLEMS AND OPPORTUNITIES OF COASTAL AND OCEAN MANAGEMENT

7. The oceans cover 70% of the surface of the globe and play a dominant and decisive role in the biogeochemical processes of the planet on local, regional and global scales. The global energy budget, climate and weather, the hydrological and carbon cycles, and atmospheric and physical processes are critically influenced by the properties of the oceanic processes. Most of the earth's life, expressed as biomass, exist within the vast volume of the oceans. The fertility of the seas is determined by the abundance of the phytoplankton. The annual phytoplankton production is estimated between 15 and 30 billion tonnes of carbon. The annual world fish production is estimated as almost 30 million tonnes of carbon. Yet our understanding of these processes is less well developed than those occurring in the terrestrial environment and atmosphere. Long-term management and sustainable development of the world's resources must be based on a sound understanding of the role of the ocean in shaping conditions on the globe and on a proper evaluation of the benefits of the marine resource base for development.

8. Uses of ocean and coastal space are multiple and serve many and diverse purposes. The traditional ones include the production of food, sources of energy, minerals and other raw materials, a base for tourism, recreation, settlement, transport and the location of both aquatic and semi-aquatic farming. Over the last 20 years, offshore oil production has greatly increased and new technological developments have opened greater areas of the sea floor to drilling and production. World seaborne trade in oil and cargo has also grown enormously in the past decades. This includes changes in the

type of vessels requiring new port development and major channel dredging. In addition, the oceans have been used as a free dump service for sewage and wastes, without the proper inclusion of damage costs.

9. Turning to fisheries, the oceans are sources of living and non-living resources which are currently treated as open access goods. The marine catch is close to the maximum production obtainable, nearly 80 million metric tons, of which ninety percent is estimated to be from coastal areas. Mariculture yields approximately 5 million metric tons and by the end of the century should be almost doubled. Increases in marine catches in the last two decades are the result of different events such as the discovery of new resources, the introduction on new fishing technologies, changes as a result of the Law of the Sea and major environmental changes. Artisanal fisheries are socially important since they contribute significantly to fisheries employment, particularly in developing countries.

10. Aside from some living resources, the high seas seem to be largely unaffected, but the physical and ecological degradation of coastal areas and the increase in pollution from land-based sources are greatly increasing. The root cause of coastal management problems lies in the distribution, absolute size and rates of growth of human populations. Rapid growth of coastal settlements, expansion of recreational areas and centres of maritime transport and concentration of industrial development along the coast, all result in accelerated coastal degradation. Sixty-five percent of cities with populations above 2.5 million inhabitants are coastal and at present 20% of the world population lives in coastal urban centres and approximately 60% may be living within 60 kilometres of the coast. This illustrates increasing human impacts on one of the most productive of ecosystems, the shallow marine and brackishwater areas. The situation in many enclosed and semi-enclosed seas, is of particular concern.

11. The capabilities of most countries to manage current problems are still insufficient and limit future choices for meeting the challenge of sustainable development. Management units for ocean and coastal affairs are generally weak and disperse. They currently reflect agencies' sectoral responsibilities rather than the boundaries of coastal systems. There is now a widespread recognition that sectoral approaches to managing coastal zones fail to resolve conflict. The responsibilities of national agencies must integrate the environmental limits of the ecosystems under management with the sectoral economic interests.

12. Moreover, current patterns of management and exploitation in the marine environment reflect historical conditions of use which no longer apply. Numbers of people in the coastal areas were low and technologies less advanced so the supply of ocean goods and services was little impacted by demand. Free use and open access when demand is low poses no problem. However, when demand nears or exceeds supply, policies of open access on the ocean environment creates conflict among users and significant resource and environmental degradation. In general, there is not an efficient user-rights system in the exclusive economic zones at the national level and in open seas at the international level.

13. Ocean legal regimes, historically have been reactive. Few recent legal regimes have been designed to operate in a proactive manner and avoid conflict. Legal instruments need to be more closely correlated with anticipatory environmental planning and management approaches designed to incorporate new perceptions of ocean uses. The new perspective on ocean management must recognize the need for proactive and anticipatory regimes that could avoid conflict, prevent environmental damage and economic loss, as an alternative to the traditional view which has been centred on reactions to conflicts in resource use, environmental degradation and prescriptive actions.

14. Geopolitical and administrative boundaries have no meaning in environmental terms since marine living resources and ecosystems do not correspond to these man-made limits. The need to maintain the natural functioning of the oceans in the face of increasing uses may result in viewing ocean space in ecosystem terms. The scales of management and the economic and legal regimes must therefore be adjusted so as to reflect not only the political or administrative boundaries but the real physical and biological units being managed e.g. large marine ecosystem, marine catchment basins and species ranges (Table 1).

15. Public perception of ocean issues is in transition. Society is gradually appreciating that the impact of intensified human activities no longer permits a casual approach to oceans as an unlimited receptacle for wastes and an endless supply of free and open access resources. The increasing active support of significant non-governmental organizations is placing ocean management to centre stage as a significant public policy issue. Broader educational and public awareness programmes are essential to enhance participation in decision-making debates. In this connection, the value of clean coastal areas for tourism and the role of coastal ecosystems in terms of erosion control and protection against storm and episodic damage are rarely included in economic or social evaluations.

16. Management refers to the attempt to provide order for a directed balance between and among the various uses of ocean space, as well as to protecting the ocean environmental viability. It encompasses several steps which include: collection, organization and analysis of data; setting of priorities; making choices related to policy directives, laws and regulations; implementation of policies; surveillance and enforcement of rules and evaluation of results. Technical solutions for many of the problems are quite well known and action is needed. However, there are still critical uncertainties for management purposes. Significant among the challenges for future ocean management are the availability, incorporation and utilization of scientific and technical information in the policy process, jurisdictional problems, the nature of ocean political constituencies and the costs associated with management efforts.

17. The overall objective for future ocean management lies in utilising the environmental and economic goods and services provided by marine and coastal ecosystems to meet development objectives whilst at the same time ensuring the long-term maintenance of marine environmental health, resource quality and ecological integrity. The oceans and coastal areas need to be viewed as a positive asset presenting opportunities for sustainable development. This will only be possible under an holistic and integrated management approach to

their utilisation. The ocean requires a full evaluation of the marine and coastal resource base and of opportunities and constraints provided within a given area or country. Where marine resources and ecosystems are shared with other states, cooperative approaches will be necessary.

III. THE MAIN LINKAGES

18. Ocean problems tend to be systemic in both scope and scale. They feature a host of linkages to other sectors, particularly because human activities which take place in marine and coastal areas do not recognize boundaries. The most important environmental linkages include: atmospheric processes, in terms of climate and weather events; effects of ozone depletion and airborne pollution; processes of environmental degradation such as loss of biodiversity; pollution (both sea and land derived) and deterioration of ecosystems. Important linkages of ocean issues with economic and developmental sectors include: in the primary sector, fisheries, agriculture and forestry, mineral extraction and freshwater supply; in the secondary sector, infrastructure, manufacturing industry and transport and, in the tertiary sector, human settlements, health, tourism, financial services and trade. Population, poverty and food security as well as the role of women and indigenous peoples are also important social linkages. However the analytic response to oceans is typically scientific and technical and the policy approach is generally specialized and categorized, rather than integrative and holistic. Oceans are receiving numerous spillover effects from land-based activities which reflect the lack of attention to these linkages. Precisely because of this disregard for linkages, many oceans problems are increasing in size and number.

19. Current attention ought to concentrate on the rational use of the coastal and near-shore areas and their resources, especially in the more vulnerable enclosed and semi-enclosed seas. The impact of sectoral activities include marine pollution from land-based and sea-based sources. Shipping and mineral extraction including oil production is the main source of uncontrolled release of toxic wastes and chemicals, oil spills, and disposal of contaminated used water. Human settlements, agricultural practices and deforestation cause severe contamination as upstream sewage, solid, toxic and hazardous wastes, nutrients and pesticides flow into near-shore zones, affecting mariculture and critical recruitment areas for fishing. The case of marine fisheries, which relates to one stock of ocean resources, is a good example of inappropriate biologic- economic interactions. The fisheries overexploitation is mainly generated by common property status and high discount rates. Both factors encourage poor practices such as habitat destruction, use of illegal techniques such as dynamite and chemicals or intensive dredging, seining, driftnetting and trawling, incidental capture of non-target species and unselective fishing. Thus there is a fundamental mismatch between the management rationale of biologists and market-oriented producers, perpetuated in part because of the lack of understanding of the linkages.

20. These multiple linkages require that ocean and coastal management strategies could be geared to at the same time produce food, serve as a medium for transportation; and encourage port development, industries, tourism and human settlements. Strategies must also aim to maintain the marine and coastal environmental and resource quality to reflect adequately the interests

and needs of future generations. The following sections are an attempt to address some of these linkages with an integrated approach to ocean management. This approach calls for integrated coastal zone management; prevention of marine pollution from all sources; management of areas requiring special protection, such as the polar seas; management of shared living resources in the high seas; application of the precautionary and ecosystem approach; addressing critical uncertainties related to climate change; capacity building, exchange of information, technical assistance and strengthening of international and regional arrangements.

IV. DEVELOPMENT OF COASTAL AREAS AND ENCLOSED SEAS

Main Issues

21. The coastal area is the interface between the land and the sea. It extends inland and seawards to a variable extent including coastal lowlands and islands, intertidal areas, salt marshes, wetlands and beaches. Six out of ten people now live within 60 kilometres of the coast and the population of the coastal zone is projected to double within the next 20 to 30 years. Its boundaries depend on political, administrative, ecological and pragmatic considerations. It can be affected by remote activities located from the edge of the watershed to the limit of the Exclusive Economic Zone (EEZ) and possibly even beyond. It is an area relevant for economic and ecological management since it involves a distinctive set of interactions between land, freshwater and ocean resources and between these resources and the people who depend on them. The resources under about 35 percent of the oceans' surface, previously recognized as part of the high seas and common property of mankind have been recently covered by national jurisdiction of coastal states.

22. Coastal degradation may result from local causes such as industrial development, urbanization and port activities, discharges of wastes and pollutants, use of inappropriate technologies, competition for space and resources and overfishing. Coastal zones concentrate negative consequences from inland development activities including inadequate management of soil and water resources, excess use of fertilizers and pesticides, deforestation, industrial pollution and river damming. Dam construction interrupts sediment inputs to coastal floodplains and deltas, accelerates erosion, interrupts fish migration, modifies seasonal flooding patterns and reduces coastal marine productivity. Harmful coastal algal blooms are linked with sewage pollution and eutrophication. Global climate change will also affect coastal zone productivity and potential for development.

23. Basic resources such as fuel, water and fertile land are in short supply and fish stocks are already heavily exploited. Overexploitation leads to biological and economic stress, loss of development opportunities and biological diversity, conflict and reduced seafood security. Extraction rates of living resources must not exceed their biological regeneration capacity. In some cases provisions must be made for regeneration within an acceptable time frame. Natural resource depletion is aggravated by the search for short-term benefits. Tenure systems are particularly inadequate in the aquatic coastal areas and will require efforts to establish them explicitly or, in the case of traditional user rights, to revive them formally.

24. Confined habitats need the most protection. Coastal lagoons are special habitats and the locus of substantial economic activity. The pressure on them and on rivers leading to them,is increasing, resulting in degradation and loss of natural resources flow patterns and life cycles and increasing natural hazards. Enclosed and semi-enclosed seas (such as the Mediterranean, the Baltic, the Red Sea and the Black Sea) are particularly vulnerable because of their limited area and relatively shallow nature, the high density of the populations and industries they support and the relatively slow exchange of their waters with larger oceanic areas.

25. A sine qua non condition to overall sustainability of the coastal areas development not dealt with in this paper is the achievement of sustainability also at each sectoral level (agriculture, forestry, fisheries, transport and urban development). The issues addressed in this section aim at the development of national capacity to sustainably develop coastal areas, optimizing the benefits which can drawn from their multiple use.

The Multiple Uses of the Coastal Areas

26. Coastal areas provide human settlements with essential life support and economic development opportunities as well as natural shore protection. In coastal rural areas, agriculture, forestry and fisheries (including aquaculture) are the main economic development activities. Coastal areas can provide, naturally, many benefits to local populations, such as: thatching materials, medical oils, firewood, timber, fish and wildlife food. In coastal urbanized areas, the most important activities relate to human residential development, industries, recreation and tourism, transport and trade. Harbours are essential centres for national and international trade and transport. In addition about 95% of world fisheries catch (80 million tons annually) comes from the near shore areas. Coastal areas are also essential to marine life (biodiversity) and productivity, operating as breeding, nursery or feeding areas for most marine species.

27. Agriculture utilizes coastal plains, wetlands and lowlands to increase food production and to provide employment. Such conversion may reduce coastal marine productivity and protection against natural hazards (floods and rainstorms), facilitate salt intrusions in the water table, and spread water-borne diseases. Poor agricultural practices release pesticides, fertilizers and silt into coastal waters.

28. The 24 million hectares of mangrove forests of the coastal areas of subtropical and tropical countries represent an important resource and their deterioration threatens coastal productivity and biodiversity. Their loss also affects availability of building material, wood, tannins, skins and hides to coastal, usually poor, populations. Upland deforestation increases erosion, sediment loadings of rivers and accelerates fresh water runoff to coastal areas, reducing water transparency and light, increasing flood risks, affecting riverine and estuarine fisheries, coral reefs and sea-grass beds.

29. Marine fisheries provide 16% of the total animal protein available in the world, low cost food for poor people, livelihood for fishermen and their families, support for related industries as well as social, economic, and political stability in the rural coastal areas, reducing migration to

overcrowded cities. However, fishing often affects the environment, threatening sensitive species often already affected by coastal nurseries degradation (e.g. turtles, coral shells, ornamental fish). Maximum Sustainable Yield (MSY) and Optimum Sustainable Yield (OSY) have been the explicit objectives of fisheries management for decades but many coastal fisheries are presently developed beyond these levels.

30. Marine aquaculture represents one of the fast growing sectors of the coastal zone, providing employment, a valuable supplement to local diets and foreign currency through exports. It requires a clean environment but intensive aquaculture practices themselves may be polluting, leading to eutrophication, release of pharmaceutical or antifouling products. Habitat conversion affects wildlife and biodiversity as well as the introduction of non-indigenous cultured species into the ocean ecosystems.

31. Manufacturing industries represent the third largest economic activity in developing countries, after agriculture and services sectors. Much of the pollution they create could be eliminated by applying clean technologies and with adequate industrial waste treatment techniques. Many coastal degraded habitats could be rehabilitated by the application of the "polluters pays" and "user pays" approaches. Extractive industries (for tin, sand, gravel and live coral mining) raise problems which can be serious, especially in island countries where the shoreline is often exposed to erosion and storm surges. Shores are protected against seastorms and erosion by natural systems, such as mangroves and other wetlands, coral reefs, and coastal barrier islands and lagoons, deflecting and absorbing much of the energy of sea storms. Their deterioration exposes populations to increased threats. Sinking and receding shorelines must be given special attention.

32. Marine transportation may conflict with fisheries, aquaculture or oil platforms. Ports and marine transportation facilities are required by offshore oil and gas development, shipping, fisheries, tourism and military operations. Major threats include destruction of mangroves and other wetlands, ecological modification of lagoons through channelling and deterioration of coastal habitats by dredging and filling operations. Waste disposal is a serious problem and will be treated in section V of this document.

33. Coastal feeder roads, highways, bridges and airports are essential to development. They also often pollute the sea, destroy critical intertidal habitats, and obstruct natural water flows, so careful planning is needed.

34. Water control and supply projects provide regulated sources of water for irrigation and housing. They also modify the quantity, quality and seasonal flow patterns of streams. This disturbs transport of nutrients and sand to coastal ecosystems. It affects mangrove forests, juvenile fish "nurseries", colonial waterbirds and other wildlife reproduction. They can seriously unbalance river-dependent ecosystems, reducing their productivity and species diversity.

35. Tourism is one of the fastest growing areas of economic activity, particularly for smaller coastal countries and island countries. Recreational

activities are, however, a potential area of conflict, sometimes threatening fishermen's livelihood. Sewage problems related to tourism may seriously affect the marine environment .

36. National security activities exist in the coastal zones and coastal seas. Coastal areas reserved for military purposes tend to be well conserved. However, naval ports and harbours, coastal airfields, and special bases of all kinds are sited in the coastal zone, usually with a high priority and intense security, preempting any other use and generating pollution.

37. Nature conservation can be considered as a type of use in its own right. Coastal areas are important ecological boundaries with high biological diversity and productivity, providing critical habitats to many species which are important for the equilibrium of the ecosystem and its capacity to respond to natural changes. Benefits from conservation may be less tangible in the short term but must be considered when allocating space and resources to competing utilizations. It may appear essential to protect particularly some representative samples and unique features of these areas as representatives of the national and global heritage.

Integrated Planning and Management of Coastal Areas

38. The above sections demonstrate that the linkages among the development sectors require proper, integrated, decision making and regulatory processes. Sectors compete for funding, resources and political advantage and special arrangements are needed to guarantee a multi- sectoral, integrated, approach. The following sections consider some of the main important aspects of planning and management of coastal areas resources with particular emphasis on Integrated Coastal Zone Management (ICZM).

39. Integrated management requires a pragmatic approach to regulate the area and mainly actors involved in coastal activities. Cooperation among the users who are affected by a coastal management programme is essential to ensure success and reduce enforcement costs. Communities with exclusive rights on marine resources, whether traditional (such as indigenous peoples) or modern, may be given responsibility for their management.

40. Integrated Coastal Zone Management (ICZM) is both a concept and a tool for inter-sectoral coordination, following modern principles of natural resources management, involving interdisciplinary processes and requiring adequate information bases and people's participation. Central governments have responsibility and authority for many marine affairs (navigation, national security, shared stocks and international relations). Provincial or regional governments usually have financial and administrative responsibilities in the coastal area. Local authorities who often deal most directly with the issues and feel the impact of actions very directly could be involved in the coordination mechanisms of national agencies.

41. A viable ICZM programme needs to be comprehensive but its content and complexity will vary from area to area according to development trends, conservation needs, traditions, norms, governmental systems and current critical issues and conflicts. A minimum programme would encompass: policy, enforcement mechanisms, an institutional arrangement for coordination and the

assigning of responsibilities for approval of permits and performance of Environmental Impact Assessment procedures (EIA). In reactive policies, crises tend to shape the programme making however corrective measures more expensive and difficult to apply. In a proactive mode, ICZM is part of development planning and may help achieve lower cost solutions, may anticipate problems early in the process and may better reconcile development and environmental concerns.

42. ICZM programmes must be related to national development policy. National policy could provide guidance for the formulation of specific marine development strategies which would follow the principles laid down in the United Nations Convention for the Law Of the Sea (UNCLOS) and identify financial, human and technical needs and institutional components. The ICZM programmes could be part of the legal framework. Regulatory instruments (taking into account existing international or regional conventions) must be developed to establish a system of regulations and permits. ICZM programmes could also provide for coordination between central and local governments and between agencies, regulating their respective competence. A major challenge in ICZM is in ensuring compatibility between global, regional and sectoral goals and targets.

43. The ICZM process starts with a Strategic Plan stating the objectives of the programme in broad terms, indicating how these objectives would be met, assigning responsibilities, identifying funding, organizing collaboration, and defining time frames. The Master Plan provides a detailed description of the coastal zone, an inventory of the resources and of critical areas in terms of protection or potential for development, and an identification of permissible uses. It elaborates the procedures for permit approval, monitoring and enforcement.

44. Geographical information systems can help greatly in compiling and analysing the required information. National research capacity needs to be strengthened to increase understanding of the coastal processes, to forecast and monitor impacts, to assess resources and environmental protection requirements, to assess new surveying and mapping technology and to develop approaches for multiple uses management and conflict resolution.

45. Evidence is required to convince users and decision makers of the utility and cost-effectiveness of the proposed management programme. A clear description of social and economic benefits could be incorporated into the Environmental Impact Assessment (EIA) or done as a separate assessment including the economic expression of the value of ecological functions to society.

46. The coastal zone is a transition of highly diverse ecosystems and habitats which are among the most biologically productive. These include extensive inter-tidal mudflats, rocky shores, sandy beaches, mangroves, saltmarshes, estuaries and other wetlands, seagrass and seaweed beds and coral reefs. There is a need to maintain essential ecological processes of the coastal ecosystems, preserve genetic diversity and ensure the sustainable utilization of species. Marine biodiversity conservation requires identification of critical habitats and application of the concept referred to "particularly sensitive sea areas" following ecological, social, economic, historical, educational or other criteria. The repair of damaged natural

systems to restore their functions and biological properties could be among the specific aims of an ICZM programme, as well as the protection of natural landforms (e.g. dunes, mangrove forests) which serve as barriers to storms and flooding and hazards reduction programmes.

47. For ICZM to be successful, a number of problems must be overcome, including: lack of political commitment, lack of trained personnel and financial support, problems of common property rights, administrative fragmentation, inadequate coastal zone boundaries, unclear goals, late action and inadequate information and research capacity. National and international sources of funds such as licence and user fees and taxes under the "polluter pays" and "user pays" principles need to be established and a commitment from the international developmental agencies to incorporate ICZM in their programmes.

48. International cooperation needs to be an integral part of comprehensive plans of action which could comprise environmental assessment, development of methodologies, policy advice and management, together with institutional and financial arrangements supporting the plans of action. Plans could provide for preferential treatment of disadvantaged countries, technical assistance and training, as well as financial aid and transfer of technologies. Experience with numerous regional intergovernmental programmes for the management of coastal areas, most of them support by legally binding agreements, has proved that the regional approach is viable and effective. These programmes tend to utilize ICZM as a framework. Control of land-based sources of marine degradation could be an integral part of these programmes. Fishery bodies could integrate environmental issues and strengthen links with relevant regional organization. Development banks and bilateral donors could play a useful role as coordinating forces.

49. Trans-national issues related to ICZM require international cooperation. For example, there may be issues of shared stocks, straddling stocks, highly migratory and endangered species, monitoring of long range fishing fleets, maritime transport, maritime boundary resolution, straddling oil and gas deposits, transboundary pollution, climate change and trade linked to environment.

50. Non Governmental Organizations (NGOs) may play an important role in the implementation of coastal integrated development, especially at the local level, where people's participation is fundamental to ensure equity, to take account of local knowledge and to gain support for the strategy. NGO'S participation is particularly important in the protection of sensitive areas and endangered species.

V. MANAGEMENT OF LIVING MARINE RESOURCES

Main Issues

51. There is a broader spectrum of different types of life forms in the ocean than on land. This is reflected in the number of species and of higher taxa (families, orders and phyla) which represent larger genetic differences than occur at the species level. However the list of marine species that exist has not yet been compiled. Although oceans cover two-thirds of the earth's

surface, it is coastal waters and nearshore ecosystems that support the majority of the world's living marine resources. Both freshwater and salt water fishes are represented in more than 20,000 species. Approximately 9,000 species are harvested, but only 22 support significant fisheries.

52. The catch statistics released by FAO, indicate that the worldwide commercial harvest of fishes, crustaceans and molluscs had reached 98.3 million metric tons in 1990. FAO has estimated an upper limit to the sustainable yield from all conventional fisheries at about 100 million metric tons annually. Of this, 86% came from the sea, and around 95% of this from the coastal and shelf seas within EEZs. This does not include the additional 24 million metric tons estimated to be taken each year in small-scale artisanal fisheries of developing nations. Coastal marine resources, especially those with high commercial value, are fully exploited or overfished practically everywhere. By the year 2000 population will double to 10 billion and percapita consumption is expected to increase, there is a need to increase all kinds of food production 2 to 3 fold. If fish catch has reached its maximum sustainable yield, that means even more pressure on land resources to grow grains, meat, etc. In this sense, the shortfall in fisheries production will be at least 20 million tons even without the collapse of fisheries that are overfished. This will further increase real prices for marine products.

53. Food from the sea is critical to balanced nutrition. Sixty per cent of people obtain between 40 and 100% of their protein from fish and consumption amounts to 7.7 kg per person per year. In developed countries consumption is about 25 kg per person per year. In Asia over 1 billion people depend almost totally on fish for animal protein. The above shortfall of 20 million tons, does not take account the conversion of a quarter of global marine production, mainly small pelagic species, into meal for livestock. Conversion to meal results from low market demand and problems of handling and marketing. Animal protein for livestock feed represents a food loss for the poor and hence a potential for development, which would increase catch value to fishermen.

54. Present valuations of marine resources are inadequate since the costs of the natural production of living and non-living resources are not reflected in present economic costings and prices. Marine product prices reflect only the economic cost of extraction and processing. In addition, since world supply is constant or declining, and prices are rising in industrialized countries, there is an increased flow of fish to industrialized countries under free trade. Many developing countries export processed fish to earn hard currency, substituting local products in their diets. This could be serious, in particular for children dependent mainly on a diet of carbohydrates. The desperate need for both food and export earnings motivates poor people to overfish, threatening the sustainability of the catch rate and interfering with sound fisheries management. Reference should be made to document A/CONF.151/PC/45 which refers to the Relationship between Poverty and Environmental Degradation.

55. Fleet expansion and overcapitalization in the last two decades resulted in increased fishing intensity and range of action of fishing fleets. High levels of exploitation lead to inefficient use of equipment purchased with

hard currency, to catch, process and store fish. Hence, uncontrolled expansion adversely affects net export earnings, foreign exchange reserves, and the stability of marine resources. In addition, trawling and dredging is also destroying organisms on the sea bed by mechanical disturbance and siltation together with illegal fishing techniques. These intensive fishing risks are reducing genetic diversity of the species.

56. Oil spills, are more visible, but perhaps less serious in the long run than discharges of nutrients and toxic chemicals, except in the case of littoral areas of semi-enclosed seas, where their effects can be particularly severe. The widespread use of nylon and other long-lasting synthetic fibres has led to concern regarding possible entanglement and "ghost fishing" by discarded or lost gear.

57. Safety of aquatic products is essential, as consumers become increasingly quality conscious and governments introduce stringent regulations to avoid loss of consumer confidence and health hazards. Discharge of pollutants such as DDT, PCBs, heavy metals and organotin compounds, may influence the living resources in many ways, even at low concentration levels. Subsequent concentration of this contaminants in the food chain has an impact on product quality. Chemical pollution may cause mass mortalities, changes in populations or ecosystems, increase occurrences of diseases, and lower growth rates in fisheries.

The State of Living Marine Resources and their Environment

59. The effects of development on the marine environment have not been uniformly felt in all ecosystems. While some systems have shown a degree of resilience to high levels of human impacts, other such as estuarine and near-shore environments and semi-enclosed seas have been seriously degraded. Alternative geographic frames of reference are necessary in any discussion of marine resources, as the political boundaries are rarely meaningful biologically.

60. Located near shore and in estuaries, marine aquaculture provides a small fraction of aquatic production. Integral to aquaculture development is the allocation of rights, and the protection of livestock against other sometimes incompatible uses of the environment. At high density, aquaculture itself causes problems such as red tides and anoxic water. In the tropics, the conversion of coastal wetlands and forest to pond culture has reduced natural shrimp nursery grounds, and eliminated sources of biodiversity. Estuaries and wetland areas deserve priority concern since their well-being is essential to many resources harvested offshore, especially in tropical areas.

61. Enclosed and semi-enclosed seas are of particular value, providing favourable environments for settlement, and containing unique resources and habitats. Intergovernmental bodies have been established for the protection of several semi-enclosed seas. For example, the Helsinki Commission and Baltic Sea Fishery Commission cover the environment and fisheries of the Baltic. However, there are major deficiencies in coordination between bodies concerned with environmental protection and those concerned with fisheries.

62. Semi-enclosed and enclosed seas show close parallels with stressed freshwater systems. Flushing times may be long, some 80 years for the Mediterranean for example, so that nutrients and toxic materials tend to accumulate. Fully enclosed systems suffer from changes in water level due to excessive utilization of incoming rivers. Nutrient enrichment and overfishing can result in a decline in diversity, and the dominance by short-lived, especially pelagic and introduced species. Development planning for semi-enclosed seas, needs to be based on integrated environmental and resource management for the entire catchment basin. The introduction of exotic species into these ecologically unique environments needs to be actively discouraged.

63. Experience in inland seas suggests that enrichment of nutrient-limited systems may initially favour shellfish culture, and increased production of small pelagic fish of low value, but at the expense of more valuable bottom-dwelling fish. More importantly, waste discharges lead to eutrophication, oxygen depletion and anoxic conditions in deeper water and on shelf areas, as in the Black Sea, with disastrous effects on the benthos, demersal and small pelagic fish. Blooms of toxic phytoplankton may result in shellfish poisoning, and untreated sewage can lead to contamination of fish and disease epidemics. Over-fertilization causes fouling of nets and cages used in aquaculture.

64. Several productive shelf environments merit special mention, especially coastal upwelling areas and shelf areas fertilized by run-off from land. Their over-exploitation under conditions of high natural variability has contributed to fish population collapses, although these appear reversible. Shelf areas fertilized by land run-off generate many productive fishery systems, as in the case of the North Sea, the Bay of Bengal and the Yellow Sea.

65. Coral reefs are characterized by many specialized species evolved over long periods within a stable environment. Mass coral reef bleaching derived from abnormally elevated sea water temperatures has also been recorded particularly in the Caribbean region. Many reef communities have been irreversibly degraded by human activities. Man's exploitation, as elsewhere, reduces their complexity, and favours simpler ecosystems and pioneering species. Most shelf fisheries still operate under open access conditions, high exploitation, and a low return on investment.

66. Recent increased pressures in shelf fisheries, long considered a marginal activity, ignores the fact that landings have reached a plateau. Under open access rules, coastal States have encouraged shelf fishing and this is causing a deterioration of the resource base. High pressures in the coastal zone to use fisheries for employment of persons displaced from agriculture, makes the control of access politically delicate. Further employment in fisheries must be looked for in the retail and processing sectors and in cultivation systems.

67. Developing coastal States often seek quick foreign exchange returns from their marine resources, by licensing foreign vessels, and through joint ventures. These mechanisms have the advantage of putting of ill-advised investment in exceeded fleet and facilities. However, the removal of open-access, setting of maximum effort levels, allocation schemes, and systems of transferring user rights, can improve sustainability, as can the allocation

of specific geographical rights within EEZ's. Environmental impacts on shelf areas and resources need to be reconciled with renewable resource use.

68. The environment of the high seas is still relatively clean, with some contamination, especially via the atmosphere and due to the widespread occurrence of floating plastic debris in the surface layers of the oceans. The resources of the high seas include about 400 potentially commercial species, but few are subject to fishing. The information concerning such species is still poor. Tunas, salmon, sharks, billfish and squid are now the main resources exploited on the high seas. Tunas feed on smaller species such as frigate mackerel and squid, which could yield perhaps ten times the landings from tuna. However, tunas integrate the oceanic food chain, and except for squid, tuna prey species are unexploited because of the high costs and low prices.

69. Tuna stocks have been heavily exploited, along with the depletion of most marine turtles, seals, whales, some seabird populations and some shark resources. Concern has recently focused on dolphins, and in some enclosed seas and coastal areas these are endangered. Recent evidence suggests that populations offshore in areas such as the Eastern Pacific, are being maintained, but by- catches in some fishing gear have led to imposition of international trade barriers.

70. Distant-water fishing vessels operate outside their historical jurisdiction, and although reporting procedures are often set up, these are very difficult for the State of the ship's flag to control. It is difficult of obtain unbiased fishery data, especially on by-catch of protected species. The need for a common data base for high seas fisheries has become more evident in recent years. The lack of a framework for limiting negative impacts on these resources was highlighted recently with respect to large-scale pelagic driftnet fisheries.

71. Preventing illegal fishing is impossible without international management and one solution has been the prohibition of certain gears within specific areas. A particular problem is the poor selectivity of the nets used in large-scale pelagic driftnet fishing; these tangle fish, squids, birds and mammals. General Assembly resolution 44/225 recognized the need to ensure that gear will catch target species with only minor by-catches.

72. Most high seas resources consist of stocks, partially included in EEZ's, which require more explicit conservation mechanisms. There is a need for a code of practice governing fishing on the high seas. Management of a stock can only occur when harvests throughout its range are known and an exchange of information occurs as prescribed under UNCLOS. Effectiveness of fisheries commissions is limited by important gaps in membership and coverage. Also, catches taken on the high seas are not always recorded accurately as to place of origin, and distant water fleets are at sea for long periods, making the use of observers difficult. The rapid movement between jurisdictions allows the processing of catches at sea. To oversee exploitation of high sea resources, radical new solutions will be required using high technology, under a new management framework.

73. The need to maintain the natural functioning of the oceans in the face of increasing and conflicting uses suggests the advisability of viewing ocean space with an ecosystem approach. Many of the constituents of ecological rationality, as developed elsewhere, are embodied in the large marine ecosystem approach for marine fisheries. Whole system management will be necessary within defined Large Marine Ecosystems (LME's).

Polar Regions

74. Polar seas are good examples of the need to apply the ecosystem approach. The 1980 Convention on Antarctic Marine Living Resources seeks to protect living resources of the region in an ecosystem context. It aims to prevent the reduction of any population, whether by direct exploitation, exploitation of its prey, or transformation of the environment, below a level that may endanger its stable recruitment. For resources, such as Antarctic krill, further exploitation depends on establishing an acceptable impact on other resources which depend on this species for food.

75. In this connection, the surrounding Southern Ocean is rich in planktonic species, and among the most biologically productive in the world. Its richness supports economically important fisheries and a number of endangered species of whales that migrate into it. A central theme of all efforts for protection and conservation in the region is the need for greatly increased research of all aspects of Antarctica's ecological structure. The Antarctic region is characterised by the absence of major marine environmental problems and a strong multilateral commitment to conservation. However, several Antarctic and sub-Antarctic living marine resources, in particular some seals, whales and slow-growing fish, have been overfished. Some of the larger whales appear slow to recover from past exploitation. Growing international support for the protection of the region has led to a series of meetings during the last few years.

76. The regime which Antarctic treaty parties are currently working to establish would constitute a comprehensive environment protection regime for the region. Negotiations are continuing about an environment protocol to the Antarctic Treaty which has been provisionally approved as detailed articles. Recent consideration has been given to establish a 50 year moratorium on mineral exploration in Antarctica, which is currently being discussed. The meeting of parties in June 1991 in Madrid did not reach a final agreement on this, however. The new Protocol establishes a Committee for Environmental Protection for the Treaty. It also includes several Annexes which strengthen the regulation of environmental impact assessment, waste disposal, marine pollution, and protected areas.

77. The problems facing Arctic flora, fauna and habitats are not confined to any one country but are circumpolar in nature. Furthermore, because of the uniqueness of Arctic ecosystems, strategies to deal with these problems differ from those of other regions. These resources have been threatened by large scale economic development projects; long range transport of pollutants and degradation of habitats. Several multilateral and bilateral agreements are currently in existence which pertain to the conservation of the Arctic resources. In June 1991, the Arctic countries with the participation of

Arctic indigenous peoples prepared an environmental protection strategy which build on the intitatives already taken nationally and by indigenous peoples to protect the Arctic environment.

Marine Mammals and Reptiles, Top Predators, Birds and Endangered Species and Sensitive Ecosystems

78. The last two centuries have witnessed the depletion of a number of populations of marine birds, reptiles and mammals, and in some cases their recovery, once protected. Fishing or hunting have caused several extinctions, while viral or bacterial infections are implicated in marine mammal die-offs in the Baltic and Mediterranean. The top predators which harvest the production in the oceanic food web are particularly susceptible to human interference. These include fish-eating marine mammals, and large predatory fish which control the densities of their prey species: all were reduced in numbers by man who is now the dominant predator in marine ecosystems.

79. Elimination of an apical predator does not always lead to a major increase in the yield of their prey. There is, however, a degree of competition between man and the other apical predators for their common prey. Thus, mammal populations, even though now reduced in size in many areas still consume as much or more of their prey species as are harvested by man. Simplistic calculations of 'surplus' yield to man in the hypothetical absence of marine mammals do not take into account their ecological role and their cultural significance to man.

80. Many large whale species have been overfished in the past, and some may be on the verge of extinction. Some species have recovered or are recovering, while others remain in serious danger of extinction. In most cases available data are insufficient to determine whether populations are increasing, decreasing or stable (Table 2 and 3). Large-scale commercial hunting of seals has ceased, at least for the present, due to uncertainties and concerns about the status of the affected stocks. The International Whaling Commission is charged with management of large whales throughout the world's oceans. Following the 10-year moratorium on harvesting, the IWC implemented in 1975, a new management procedure designed to deal with whale stocks on an individual basis rather than by a blanket ban. A separate management regime for aboriginal subsistence whaling was also instituted. In 1982, IWC adopted a proposal that the "catch limits for the killing of commercial purposes of whales from all stocks for the 1986 and the 1985/86 pelagic seasons and thereafter shall be zero. Since 1986 the IWC Scientific Committee has undertaken a Comprehensive Assessment of whale stocks, including the examination of current stock size, recent population trends, carrying capacity and productivity. Because of the considerable scientific uncertainty over the numbers of whales of different species and in different geographical stocks, it is still not clear what are the prospects for recovery of some stocks. So far the Scientific Committee has carried out detailed assessments of three groups of whales, gray whales in the eastern North Pacific and minke whales in the Southern Hemisphere and the North Atlantic (Table 4). Support could be provided to the IWC in its efforts to extend the bans on harvesting of endangered species and to restore stocks of highly migratory stocks of large whales.

81. Large-scale commercial hunting presently poses no immediate threat to seals or whales. In recent years there have been increases in the commercial exploitation of certain small cetaceans and in the number of marine mammals caught and killed incidentally in fisheries. The harvesting of non-migratory marine mammals for food or for predator control within EEZ's needs to take into account the slow rate of replenishment of these populations. The management of stocks of small marine mammals, turtles and birds is less assured, and few explicit mechanisms guarantee their survival. For example, for marine turtles, habitat degradation has been an important cause for depletion, together with harvesting for food, leather and other products. Incidental catches of marine mammals, turtles and birds need to be reduced, and, for endangered species, eliminated as far as possible.

82. A number of important steps also have been taken in the international arena in the last two decades to foster the conservation and recovery of marine mammals. Example are, the Convention on the Conservation of Antarctic Seals, the Agreement on the Conservation of Polar Bears, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and the Convention on the Conservation of Antarctic Marine Living Resources. There is also the FAO-sponsored "Scientific Consultation on the Conservation and Management of Marine Mammals and Their Environment" in 1976 and subsequently, the United Nations Environment Programme's Global Plan of Action for the Conservation of Marine Mammals.

Sustainable Use of Living Marine Resources

83. The United Nations Convention on the Law of the Sea (UNCLOS) provides the framework for fisheries management and calls on coastal states to promote optimal utilization of the living resources in their Exclusive Economic Zones (EEZ), while giving states the right to determine the allowable catch. In 1988, the FAO Council defined sustainable development as "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development conserves land, water, plant and genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable".

84. This definition was aimed primarily at the harvesting of resources, and recognises the possibility of economic growth from exploiting new resources, without compromising sustainability. It encompasses the need to adjust levels of use of resources and diversify this usage, and to render exploitation more productive and cost effective by reducing its impacts on the ecosystem, its environment, and on other human endeavours. An additional action involves restoring degraded systems to productive use.

85. Conserving living marine resources has been a goal of fisheries management for decades, and various targets have been proposed, namely Maximum Sustainable Yield (MSY) and Maximum Economic Yield (MEY). Despite being the main benchmark for optimal exploitation in the UNCLOS treaty, 'single species MSY' may not be compatible with Sustainable Development, which requires other, whole-ecosystem criteria. Maximum Economic yield (MEY) implies lower rates of capitalization, higher catch rates, and greater stability than MSY.

86. The abundance of most fish depends on both biotic and environmental factors. Short and medium term natural variations in population numbers and longer-term fluctuations in the marine environment and in fish abundance also occur. Heavy fishing can change the relative abundance of all species in the fish community linked to it as competitors or predators. This change is not necessarily irreversible as long as the species capacity to reproduce is not endangered and the integrity of the environment is not compromised. Recruitment variations are related to oceanic conditions, and to the size of the surviving bloodstock. In this connection, expected global climate change will be superimposed on wide natural and man-made variations and its impacts on fisheries and aquaculture are difficult to predict.

87. The sustainable use of living marine resources has more in common with wildlife management than other uses of terrestrial ecosystems. The intensity of marine resource exploitation that can be sustained, however, is easily exceeded. The themes of conservation, development and rights of access need to be reconciled before major advances in marine resource management can be expected. The conservation of aquatic biodiversity is a top priority. Although few species extinctions have resulted from fishing, this is not true for some populations and races, and other human activities which have had critical effects on marine habitats.

88. Aquaculture development has followed two separate paths: that of rural, extensive aquaculture, practised mainly in developing countries, and that of commercial and intensive aquaculture practised in both developed and developing countries. The potential of marine aquaculture may be less than has been previously thought given environmental degradation in some areas. The role of mariculture in relation to food security is strictly limited since most cultivated marine finfish are predators, and need protein (fish) feeds. This is not the case for plankton and detritus feeding mollusca or for seaweed, whose cultivation offers great potential if markets can be found. Only a few developing countries have enacted legislation supporting aquaculture. So far, the setting-up of aquaculture enterprises is often being constrained by regulations on land tenure, water use, environmental concerns and public health. A restatement of the pertinent legislation is convenient. It is important to note that the present number of species raised in aquaculture is relatively limited and concern needs to be given to maintaining wild species diversity until more is known about a considerable number of other species.

89. Developing strategies for sustainable use of living marine resources and their environments faces problems from open access strategies that do not apply on land, where the ownership of resources and environment is long established. For the oceans, the framework of rights and responsibilities reflected in the United Nations Convention on the Law of the Sea provides for national allocation of rights. However, many coastal states have not developed strategies for allocation rights and responsibilities within their Exclusive Economic Zones. Still fewer have established frameworks for collaboration with neighbouring States, or have formalized conditions for access by foreign fishing fleets.

90. Sustainable use of living marine resources and fishery development must be closely linked to research. The conservation of resources which span two

or more EEZ's under UNCLOS, necessitates exchange of data as an essential precondition to management, and could form part of any agreement on exploitation. The status of stocks can only be determined indirectly by expenditure on research vessels and fisheries statistical systems. Adequate monitoring of stocks is essential for management and conservation. Monitoring this sector requires trained personnel for the collection of statistics and resource assessment, socio-economic analysis, fishing technology, marketing and quality control; surveillance, and fisheries legislation. Required also is a permanent research team providing advice to government and the fishing industry, and input from the fishing industry in practical management.

91. The technology needed for better understanding the oceans and environment needs to be made available to institutes in developing countries. Geographic Information Systems for living marine resources, the fisheries, their environment, and the coastal communities involved in their sustainable use, need developing as an aid to decision-making. The exchange of software and data bases needs to be promoted. Systems for the collection of reliable statistics need to be established prior to exploitation. Accurate information on removals from, as well as inputs to, and impacts on, the marine environment need to be conditions of access.

92. The areas for future development may be considered under two time horizons; those that are currently feasible and those that require marine research and development. Relevant research priorities include: multi-species resource management and ecosystem studies, the monitoring of water-borne and atmospheric transmitted pollutants, the economic consequences of ecosystem changes, the improvement of fishing gear, and the understanding of the reaction of fish, marine mammals and marine reptiles to fishing gear and other man-made harvesting techniques. Some future possibilities that require technological and scientific investigation as well as careful cost-benefit analysis before large-scale application, include enhancing productivity, offshore aquaculture, biotechnology and the use of genetic resources, and large-scale artificial reefs.

93. The negotiation of fishing agreements, and development of appropriate management schemes require a national research capability as well as the development of new technologies to improve safety and effectiveness of fisherpersons and selective gear. The reduction in the loss of edible by-catch in fishery operations whether lost at sea, in storage, during processing or in transport, offers potential for appropriate technological solutions.

94. Adequate funding of national institutes studying living marine resources is essential, and intergovernmental agencies and governments could be encouraged to support inter-disciplinary research in marine science. The costs of research and management could, where possible, be covered from revenues from renewable resource use, and private sector involvement could be encouraged.

Small-Scale Fisheries, Women and Indigenous Peoples

95. Artisanal fishermen in coastal and shallow shelf seas form over 90 percent of people employed in fisheries. Traditional systems of resource

management and rights of access of indigenous peoples need to be preserved and strengthened. Artisanal fisheries are an energy efficient method of harvesting and an essential component of coastal communities. Inshore fishing by larger vessels affects the marine environment and may force artisanal fishermen to harvest juveniles in the nursery areas. Space allocation for small scale fishermen is an urgent action that could be accomplished with the general idea of reserving inshore fishing grounds to the use of small-scale fisheries by allocating 20 nautical mile zone as an average.

96. Small-scale fisheries are proving more effective than large- scale fisheries in wider sharing of benefits of marine resources, with greater employment opportunities in the sector. The benefits from marine resources need to be spread more evenly in the chain between harvesters and consumers, and the traditional role of women in processing and marketing needs to be strengthened. The resilience of fishing communities can be improved by diversification of technologies with seasonal or part-time revenues from fish processing, aquaculture, tourism and small-scale farming.

97. Throughout the world the fishing industry has long been considered a male occupation and in fact many international agencies and businesses develop programs solely for the fishermen without considering women's efforts. Women play an important role in fishing communities all over the world. This role encompasses social and economic responsibilities and duties, including marketing, processing and harvesting of aquatic products. FAO has established a group on Women-in-Fisheries matters and a regular review of pipeline project proposals and ideas as to their adequate consideration of women as a target group. FAO also prepared guidelines to ensure that women are considered in every stage of identification, preparation, implementation and evaluation of development activities. It is interesting to note that a shift of emphasis with regard to the theory of development planning for women has occurred. The practical limitations of focusing on women in isolation have been recognised and the need to look at gender and development has emerged -gender as a reflection of the social relationship between men and women and the gender differences shaped by ideological, historical, religious, ethnic, economic and cultural determinants. Women, Environmental and Development Network is aiming to document and legitimize the knowledge and women's roles as managers of natural resources in both traditional and contemporary contexts. Strategies towards strengthening their capacities as resource managers is essential. One of the keys is to ensure that fisherwomen have access to credit institutions so that they can finance their own ventures. Technology has to be developed to meet the needs of improving processing and to allow women to improved fishing crafts and fishing techniques. Transfer of technology for women needs to be a priority.

98. Traditional fisheries management practices of indigenous peoples, e.g. Maori, reflects the value placed on sustaining natural resources for use by future generations. These practices reflect the view that all living and non living thing interact to varying degrees strongly linked to spiritual and cultural values and beliefs. Fishing gears are fashioned to ensure selective fishing so the wrong fish is not taken at the wrong time and place. The indigenous peoples must be acknowledged the right to strengthen their own regional base. Recognition of indigenous peoples' special economic rights to wildlife, fish and other resources need to be reconciled with the national

management goals. The inter-tribal fishery councils in the northwest coast of the United States are a very good example of resource co-management systems that could be extended to other indigenous communities. Other examples of territorial autonomy include the Greenland Home Rule Government, the Kuna Comarca of San Blas, in Panama and Nicaragua's Atlantic Coast. Concrete studies of these systems are needed as well as the confidence of governments to enable indigenous peoples to make environmental decisions for themselves.

99. Promoting a more equitable sharing of the benefits of living marine resources in the context of limited access would contribute to the development of coastal communities. It would encourage resource development, diversification of products, and better livelihood conditions for small-scale fishermen, women and indigenous peoples. Relevant research needs to be undertaken on the nature and effectiveness of traditional forms of fisheries management, among indigenous peoples and other artisanal fishing communities, along with information on the impact of large-scale fishing on these traditional systems' sustainability. This would prove that it is feasible to place greater emphasis on artisanal scale vessels equipped with appropriate technology.

National, Regional and International Strategies

100. Management of fisheries is an essential government function, and should not be postponed until overfishing is evident. Marine fisheries are not self-regulating. Preemptive regulation needs to begin early in development, and need not to await complete data. An over-optimistic evaluation, or no action at all, may lead to collapse, and the need for expensive restoration measures. Resources can be preserved and rent extracted, only by reducing access to users to levels that will not affect long-term productivity by issuing limited licences to fish, low financial incentives to new participants, encouragement of group control with the allocation of user rights to areas of continental shelf, and the institution of closure zones and marine parks.

101. Effective government control over the marine resources of the EEZ and a national legislative framework for the protection of living marine resources and critical and sensitive marine areas and habitats could be developed. In this context, user rights and responsibilities need to be made explicit, with the rights to legal redress in the case of adverse impacts on resources and environments by third parties. Licence fees and penalties for infringements could be commensurate with the value of the resource or environment, and could be used for sustainable management. If appropriate, a mechanism for transfer of user rights could be instituted. The delegation of rights and responsibilities to regions, communities or even individuals, appears to be the key to sustainable development. Mechanisms for coordination between concerned organizations, the private sector and government departments need to be established which incorporate strategic planning into decision making. The adoption of common procedures for control and surveillance would be cost effective and encourage mutual confidence.

102. Responsible fishing is a precondition for sustainability, and requires more selective fishing gear and methods. Even when carried out responsibly, fishing will inevitably capture non-target species in small numbers.

Substitutes for some types of fishing gear cannot readily be found to meet excessively rigorous criteria. Unduly restrictive norms may bring many forms of commercial fishing to an end. The hardship thus caused to human coastal populations and the loss of invaluable protein resources, will have to be taken into account in setting conservationist measures.

103. The promotion of investment in infrastructure of coastal and shelf areas is essential to increase environmentally-sustainable food production. Further investment in harvesting technology need to be discouraged depending on the status of most shelf fisheries. The proportion of fish for human food could be increased by avoiding wastage, and improving techniques of capture, handling and transportation. Harvesting practices must avoid wastage and reduce the capture of non-target, regulated, or endangered species. Specific controls and codes of practice for fishermen in relation to reducing these harmful impacts of fishing need introducing. The problems of the passage of migratory fish through straits and up estuaries need to be more explicitly addressed.

104. Fish for human food could take priority over its other uses. If markets exist, value needs to be added to limited catches by development of processing and storage facilities and through improved market information. Substitutes could be found where possible for fish protein as animal feed. The importance of fish for nutrition needs to be promoted and consumer confidence maintained. Quality assurance and fish inspection systems need to be introduced. International cooperation in transfer of technology could assist developing country exporters meet the standards for world trade.

105. Specialized agencies and funding organizations could assist in the identification of investment potentials, and the formulation of development projects that incorporate environmental monitoring and sustainability. To ensure continuity and self-sufficiency, funding needs to be provided over medium to long periods, until environmental and resource management functions are supported by revenues in the form of licence fees or rents paid by users.

106. Prices in the fisheries sector must reflect the true social and environmental costs of production and use. The true value of environmental services could be included in the price rather than being treated as "free goods". In addition, the inclusion of a premium to reflect the risks and uncertainties concerning the environmental consequences of investments may be needed, and lowered discount rates to reflect the interests of future generations. Improving valuation techniques and environmental accounting is vital to achieving sustainable development. Substitution of imported products by those locally available, as well as maximizing product value, are other economic goals.

107. There is a concern that conservation may be used inappropriately as an excuse to protect home fishing industries. This is likely to lead to trade disputes which could be settled on the basis of scientific evidence. Efforts to improve knowledge about marine ecosystems will help. There is, therefore, a need to examine the impacts of trading patterns on the environment and to establish more effective instruments.

International Commissions for Resource Management

108. UNCLOS explicitly recognizes that a coastal State has sovereign rights to exploit the resources within its EEZ. The question of how to set the total allowable catch and determine surpluses has been treated differently by many countries. Taking a surplus by non-nationals affects the catch rate and profitability of the national fleet. Fisheries commissions face serious problems in managing modern fishing fleets, which are extremely mobile and independent. 'Real time' management require fisheries inspection in port, at-sea observers, radio transmission of daily catches. A computerized data system is needed so that the fishery can be closed when the total allowable catch (TAC) has been achieved. A licensing system with realistic fees, regular research vessel surveys, a team of resource experts, and mechanisms of consultation are also needed. Aerial surveillance and standard call signs for vessels authorized to participate in the fishery, are other requirements.

109. Following UNCLOS, States are charged to cooperate in shared resources management or to use an existing fishery commission. To date, the number of shared resources to which such a formal mechanism has been applied are in a minority. Many transboundary resources are shared by only two adjacent countries, and can be managed bilaterally. Promoting the development of bilateral commissions, as appropriate, may be a useful initiative.

110. Some multi-national groupings, such as the Forum Fishery Agency for the Central Pacific, effectively function as fishery commissions for the combined EEZ's of their member states. Clearly there is a need for a comprehensive review of the coverage of areas and species by management bodies, and their powers and availability of funding, to rationalize anomalies, and to define areas for collaborative action, especially for high seas resources.

111. Regional scenarios for cooperative action could be developed for coastal and semi-enclosed seas, and common data bases on environment, resources and socio-economic activities need to be developed. International agencies could provide disinterested advice on request from States facing problems relating to common resources and environments, and could promote regional cooperative research and workshops.

112. Regional approaches to action in semi-enclosed seas must be adopted, since actions within each sub-zone are ineffective without compliance throughout the whole marine ecosystem. Agreement is needed by coastal States on a management body responsible for coordinating national actions, and maintaining the marine environment in a condition such that resource use is feasible in the indefinite future.

113. Only the high seas outside of national jurisdiction are truly 'commons'; therefore formal international management is essential for resources beyond the limits of the EEZ. Present regional conventions do not provide an adequate substitute for such a regime. There is a need for more specific mechanisms for managing the resources of high seas areas between the various regional commissions overlapping with high seas areas, which are concerned with resources and environment. Fisheries commissions and other bodies concerned with shared resource management could be given responsibility for maintaining resource levels, and powers to ensure that environmental

degradation does not occur. Financial support could be commensurate with the full range of operations that management of technically sophisticated fishing fleets require.

114. International organizations and commissions concerned with marine affairs need to promote effective cooperation between themselves and their Member States. Their regional bodies and programmes could review and, if necessary, change their modus operandi and criteria for action, to better coordinate sustainable development of marine resources and environments.

VI. MARINE POLLUTION PREVENTION AND CONTROL STRATEGIES

Main Issues

115. Human fingerprints are found everywhere in the oceans. Chemical contamination and litter can be observed from the poles to the tropics and from beaches to abyssal depths. But conditions in the marine environment vary widely. The open sea is still relatively clean. Low levels of lead, synthetic organic compounds and artificial radionuclides, though widely detectable, do not appear to be biologically significant, but they have not been adequately studied to date so as to allow firm conclusions as to their impacts on the deeper oceans. Oil slicks and litter are common along sea lanes, but are, with localized exceptions, of minor consequence to open-ocean communities of organisms.

116. In contrast to the open ocean, the margins of the sea are affected by man almost everywhere and encroachment on coastal areas continues worldwide particularly in poorly flushed areas, as mentioned in section IV. A wide range of activities on land contributes to the release of contaminants to the sea either directly or carried by rivers and the atmosphere, while sea-borne activities make a minor addition. Forty per cent of contaminants arrive via rivers, and thirty percent via the atmosphere, while maritime and dumping activities contribute ten percent each. Only a small part of those contaminants has spread beyond the limits of the continental shelf.

117. A problem currently receiving attention is the protection of the polar regions from polluting activities. In the Antarctic, the importance of preserving the relatively pristine state of the region for scientific research is a high priority. Antarctica is of critical importance to research on ozone depletion and the greenhouse effect. The low rate of biodegradation of oil and other organic and chemical wastes at the prevailing temperatures is one of many considerations that have led Antarctic decision makers to adopt special precautions to ensure protection and conservation of the natural resources and the Antarctic ecosystem. These measures include special waste collection and removal requirements, as well as the recent "special areas" designation of the Antarctic under Annexes I and V of MARPOL 73/78. In important respects, these and other measures have been the subject of special negotiations surrounding a new protocol that is designed to enhance the prospects of comprehensive environmental protection for the Antarctic regions. Parties will be required to develop stringent environmental assessments for activities as to avoid environmental damage and to develop contingency plans for environmental accidents. Particular attention is given to the disposal of wastes from scientific stations located in Antarctica.

118. The Arctic is one of the areas most vulnerable to adverse impacts from chronic and acute oil pollution due to low temperature, periods with no light and ice cover. The highest risk of oil spills is connected with transportation activities and production. Strict standards in the transportation of oil in the Arctic will be developed under the framework of the International Maritime Organization. In addition, the Arctic countries recently defined six specific pollution issues to be addressed as part of the Arctic Environmental Protection Strategy. These issues are associated with persistent organic contaminants, oil, heavy metals, noise, radioactivity, and acidification. State of the Environment Reports were prepared on each of these topics. The potential impact of these specific pollutants on Arctic flora and fauna underlined the need to consider establishing a mechanism to facilitate a cooperative approach to their conservation. The Arctic Countries also agreed to the framework for taking early cooperative action on emergency prevention, preparedness and response since the Arctic environment is particularly vulnerable to accidental discharges and uncontrolled releases of pollutants.

119. The primary targets of anticipatory, precautionary and other control mechanisms have been on pollution caused by substances and wastes, either intentionally or accidentally discharged into the sea. These include industrial waste disposal by pipelines or by dumping from vessels at sea, the operation of marine incineration vessels, disposal of dredged material and operational discharges from ships. All these activities are addressed by international agreements although inputs from pipelines and other land-based sources are not presently covered by global arrangements other than the voluntary, recommendatory 1985 Montreal Guidelines.

120. The substances and wastes that cause marine pollution are numerous. Some substances are more likely to cause pollution because they are very widely used, their movement is difficult to control, they are persistent, they have relatively high toxicity, they accumulate readily in living tissues or some combination of these factors. The major pollutants include biological contaminants such as infectious bacteria and viruses, nutrients, toxic pollutants such as metals and hydrocarbons, radionucleids and plastics and other solid wastes. Reference should be made to documents A/CONF.151/PC/74, A/CONF.151/PC/75 and A/CONF.151/PC/76 which refer to Toxic Chemicals, Hazardous Wastes and Sewage and Solid Wastes respectively. These documents deal in detail with sound waste management policies including the reduction of wastes, recycling and application of various waste treatment and disposal options. These documents refer to all sources of polluting substances including those entering coastal areas from land-based discharges, from dumping, from the atmosphere and from sea-based activities such as offshore production and shipping.

Marine Pollution from Non-maritime Sources

121. The first operative convention which specifically addresses marine pollution by substances and wastes on a world-wide basis is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Dumping Convention). The LDC, similar to its regional counterparts in the North-East Atlantic (Oslo Convention, Baltic/Helsinki Convention), Mediterranean and South Pacific (protocols to the Barcelona and

Noumea Conventions respectively), regulates the disposal at sea of industrial wastes (including agricultural and fishery wastes), sewage sludges and dredged material. In recent years, Contracting Parties to the London Dumping Convention have agreed to suspend the dumping of low-level radioactive wastes, to phase out the use of marine incineration vessels, and to set a 1995 deadline for the termination of dumping of most forms of industrial waste. Activities and issues related to the LDC are addressed in more detail in document A/CONF.151/PC/31.

122. An initiative of significant consequence for the marine environment is the finalization of the Global Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 (the Basel Convention). That Convention is designed to control the export and transport of hazardous wastes, and is expected to afford additional protection to the marine environment through improved supervision of disposal arrangements for exported waste and a reduction in hazardous cargoes. At the same time, regional action by African countries under the auspices of the Organisation of African Unity to adopt the Bamako Convention on hazardous waste trade reflects a growing recognition that the most effective solution lies in the reduction of hazardous wastes at source, coupled with a strong demand that such wastes should not be shipped to other countries, especially developing countries.

123. Several approaches to marine pollution prevention are of increasing importance at national, regional and global levels. A new and significant initiative is a convention on Environmental Impact Assessment in a Transboundary Context currently under preparation within the Economic Commission for Europe (UNECE). This convention will oblige signatories to prepare environmental impact assessments on specified projects that are "likely to cause significant [adverse] transboundary impacts" and to consult affected parties before a decision is reached to proceed with the proposal. The convention is scheduled for signature in 1991 and will mark a new stage in the development of international measures to control the dispersion of pollutants through marine and other environments.

124. Other important initiatives in preventing marine pollution by indirect means are illustrated by the projects and programmes of international agencies. In this regard, the work of UNEP in drawing up Action Plans as part of its Regional Sea Programme (there are now altogether 10 such Action Plans) is of particular relevance to less developed regions and extensive areas are now covered by these plans. Inter-agency initiatives in which IOC/Unesco and IMO are particularly active include training of scientists and administrators in aspects of monitoring, oceanography, waste management and marine pollution related to the shipping industry. These are essential elements of international efforts to relation to protection and management of the marine environment.

125. In general land-based sources is the dominant threat to the health of marine environment. It is estimated that over 75% of total pollutants entering the world's oceans are from land-based activites. The distinction between point and non-point sources is relevant for management purposes and is based on the specificity of the source and relates to the existence, or lack thereof, of an identifiable outfall. Point sources can be divided into two sectors: industrial discharges and municipal sources, i.e. sewage.

Non-point sources are those that come from dispersed runoffs from agricultural, industrial and construction activities. Common examples include pesticide and fertilizer runoff; salt; petroleum and other contaminants from roadways, parking lots and other hard surfaces; as well as volatile organic emissions.

126. Although matters related to land-based sources of marine pollution are the subject of a detailed separate report presented as Document A/CONF.151/PC/71 it is important to underline the need to establish a global strategy and a companion set of regional and national land-based sources action plans that could build upon the Montreal Guidelines principles. This important issue could also be seen in the context of the integrated coastal zone management plans as well as other sectoral components such as agriculture, human settlements, freshwater pollution and industry.

127. The problems of sewage management, particularly in densely populated coastal communities, are amongst the most urgent to be addressed by those responsible for marine environmental protection. Options to use sewage beneficially are available if carefully managed either on land or in oceans. In many cases, however industries discharge to municipal facilities. The separation of industrial from municipal discharges is one of the first steps to be taken. In this connection manufacturing industries may produce toxic wastes that damage the marine environment. Chemicals used as intermediates in other industries, paints, preservatives, disinfectants, dyes, pharmaceuticals, cleaning agents and biocides used in agriculture and many other products may, without careful use and surveillance throughout their life-span, reach the sea and contribute to marine pollution. Certain persistent, synthetic organic substances such as organohalogen compounds (e.g. solvents, pesticides and heat transfer fluids) are known to be particularly hazardous. Thus, their production and use need to be prohibited or strictly regulated.

128. In shallow or semi-enclosed marine areas excessive nutrient concentrations, such as for nitrogen or phosphorous, stimulate growth of phytoplankton and other plants. Damage from nutrient enrichment may result from deoxygenation following plant decomposition, substrate changes, changes in relative abundance of commercial species, enhanced production of algal toxins and increased turbidity of recreational waters. Human activities which increase nutrient supply to the marine environment include fertilizer application, sewage disposal and a range of industrial operations such as food processing, extraction of ores and uses of detergents. Ammonia is a form of nitrogen which occurs in many wastes and may readily achieve concentrations in water that are toxic to aquatic organisms. For these reasons, nutrients warrant particular attention as potential marine pollutants. Identifying, limiting and monitoring uses and emissions of nutrients is a necessary part of marine environmental protection and management.

129. Mining, mineral extraction and smelting operations, mobilize huge quantities of silts. Inadequate management of mine tailings and other mineral residues can lead to a wide range of "downstream" problems in estuaries and coastal areas through changes to habitats, sediment and water chemistry. Agriculture, mariculture, control of insect-borne diseases, metal plating operations, tanning, photographic processing, dyeing and marine anti-foulings applications depend on chemicals and processes that, either directly or

indirectly, can release potentially harmful substances into the environment. Careful planning, siting, monitoring and enforcement procedures are needed to prevent chemical releases from such operations causing marine pollution.

130. Industrial discharges through pipelines are, in general, amenable to straightforward systems of regulation, i.e. loads and concentrations of contaminants can be limited by licensing, in accordance with the best available or clean technologies for the industries concerned, and by monitoring and enforcement of the license conditions. Uniform emission standards (UES) can be developed for particular categories of industry, by consultation with the industrial sectors concerned. UESs for certain sectors, such as industries using hazardous metals (e.g. mercury, cadmium), already exist in various countries and regions, for example the N-E Atlantic region where land-based sources are regulated under the Paris Convention.

131. Environmental quality objectives (EQO) are also important tools for controlling marine pollution. These are numerical values specifying the limits of contamination by specified substances in water, sediments or biota, in order to sustain aquatic life and protect human health. They are particularly effective when used in conjunction with UESs because they provide a means of evaluating the combined effects of multiple sources on the receiving environment. However, an EQO approach necessitates regular and systematic field monitoring. Where they are based on sufficient evidence, they can be an effective measure to protect the marine environment; however, if the status of knowledge is insufficient, EQOs are of little value. The range of EQOs currently in use is rather limited but, through the application of research into cause/effect relationships, it is anticipated that many more substances could be regulated in this way, in conjunction with UES, using locally applicable criteria.

Marine Pollution by Shipping Activities

132. Although shipping contributes little more than 10% of all contaminants to the marine environment, its global character and ease of control, at least in near-shore areas, has made it the target of focused international action. The most important global agreements are: the International Convention on the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating there to (MARPOL 73/78); the International Convention on Safety of Life at Sea (SOLAS 1974); the Convention on the International Regulations for Preventing Collisions at Sea (COLREG 1972); and the International Convention on Loadlines (LL 1966).

133. MARPOL 73/78 regulates prevention of marine pollution by oil noxious liquid substances carried in bulk; harmful substances carried in packaged form or in freight containers, portable tanks for road and rail tank wagons; sewage discharges from ships; and garbage from ships. The main contributions of SOLAS to protection of the marine environment are international requirements for the design and construction of vessels that help to ensure the integrity of cargoes under adverse conditions. COLREG helps to avoid collisions at sea, in particular by the establishment of traffic separation schemes. The "Loadline" Convention places limits on the draught to which a ship may be loaded and its Annexes contain technical safety measures to ensure the watertight integrity of hulls below the freeboard decks. Taken together,

these Conventions and the many technical provisions they contain constitute an extensive range of safety controls for the protection of the marine environment from pollution by shipping.

134. The restrictions placed on waste disposal from vessels at sea make it imperative that ports are equipped with facilities to receive such wastes. Needless to say the availability of such facilities is seriously inadequate. The costs of port reception facilities vary considerably with the types of ship using the port and the lengths of prior voyages. Technically, garbage is relatively straight forward to collect, but large quantities may present difficulties in disposal. Fuel oil sludge, used lubricants and bilge oil need slightly more sophisticated equipment for collection and treatment. The most difficult problem to resolve in this regard is the collection and treatment of large volumes of oil-contaminated ballast water from crude oil tankers, which requires storage tanks, oily-water treatment plants and submarine deballasting pipelines from the berth to the shore. The main obstacle to the provision of such facilities is financial rather than technical.

135. An impediment to implementing requirements for port facilities is the view that public funds need not to be used when clearly, in accordance with the "polluter pays principle", the costs could be borne by the entities concerned, i.e. refineries, chemical companies and port operating companies. In cases where the responsibility for providing facilities cannot be handed over to a single operating industry, consideration could be given to contracting to private operators the handling and disposal of wastes generated by vessels, with financing by imposing a tariff on ships using the port (e.g. through port dues) or individual charges on ships for the use of such services. A recent study commissioned by IMO in co-operation with INTERTANKO, ICS and the Commission of the European Communities has suggested that the large investments required for tanker deballasting facilities could be serviced by automatic inclusion of reception facility costs in oil transportation charges. Where reception facilities exist, the running and depreciation costs could be offset by the revenue so received; however, where no facilities exist this element of the oil transportation charge would be diverted to a special "Fund for Reception Facilities (FRF)" from which loans could be serviced.

136. Certain sea areas may require special protection from potential damage by shipping. Such protection is provided under MARPOL 73/78 where restrictions are being imposed in larger enclosed or semi-enclosed areas designated Special Areas (Reg.10, Annex I, as amended in November 1990). The intention is to reduce or prevent pollution for instance by prohibiting the discharge of garbage from vessels and by strictly regulating any operational discharge of oil or oily water from tankers and of noxious liquid substances from chemical tankers. Nine such areas have so far been designated, most recently the North Sea and the Antarctic region south of 60 degrees South latitude. Special protection to smaller sea areas can be provided under a scheme recently adopted by Member States of IMO provided certain agreed criteria for their selection have been satisfied. The first area adopted under this scheme (November 1990) was the Great Barrier Reef Park area, Australia.

Marine Pollution Emergencies

137. Damage to ships through collision, grounding or adverse weather conditions can result in releases of fuels and hazardous chemical cargoes that are capable of causing significant harm to the marine environment. There are currently some 13 regional multilateral agreements on co-operation in combating marine pollution emergencies either in force or under development.

138. In several regions, multilateral agreements are reinforced by the establishment of bilateral agreements, operational sub-regional contingency plans, and regional centres and equipment bases. In several regions of the world, oil company co-operatives have been established to facilitate a rapid and efficient response to oil spills beyond the immediate capabilities of one company. Major oil companies have also established equipment bases in Europe, North America and Southeast Asia.

139. In general, regional intergovernmental agreements cover some, if not all, of the following main elements or obligations: pollution reporting requirements; mutual assistance and co- operation; establishment of a national system of preparedness and response; exchange of information; and institutional arrangements to facilitate implementation. To remain viable such agreements require a certain level of technical and administrative infrastructure and continuous review and monitoring of their effectiveness. Many developing countries participating in regional agreements lack the material resources and trained manpower to implement such agreements. In some regions, most of the countries participating are in this situation, and the agreement, by itself, is therefore of limited value or use.

140. In part, the International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC) addresses this problem, providing a global, legal framework for cooperation in combating major oil pollution incidents regardless of sources. The Convention also contains mandatory requirements for oil pollution emergency plans for ships, offshore structures, sea ports and oil handling facilities; sets out basic principles on the reimbursement of costs of assistance; facilitates the transfer of technology; encourages research and development; and provides technical assistance, information and advice through IMO. The oil spills associated with the recent war in the Persian Gulf have presented a special challenge to the resources, skills and talents of IMO, States and the private sector in dealing with the offshore and onshore spillage of oil.

141. Questions of liability and compensation for oil pollution damage caused by oil spills from laden tankers are governed by two international conventions adopted under the auspices of IMO: the 1969 Convention on Civil Liability for Oil Pollution Damage (Civil Liability Convention) and the 1971 Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention), or CLC/Fund Conventions. The regime of compensation established by the Civil Liability Convention and the Fund Convention contributes to the protection of the marine environment, providing compensation for clean-up costs and for measures taken to prevent or minimize oil pollution damage, though the levels of allowable reimbursement need updating. Such updating was sought under the CLC/Fund Protocols negotiated in 1984 under IMO's auspices, but those Protocols have garnered few

ratifications, due in large measure to the United States decision not to ratify because of the CLC's preemption of unlimited liability requirements under United States law. IMO, in consultation with Member States, is currently reviewing alternative options for strengthening the liability and compensation requirements of the underlying CLC/Fund regimes.

142. While the CLC/Fund treaties address oil spills, IMO has included in its work programme, as a priority item, the development of a convention on liability and compensation in connection with the carriage of hazardous and noxious substances by sea (HNS). The main purposes of the prospective instrument are to implement an international global liability regime which would provide for adequate compensation to the victims of damages caused by dangerous goods during their carriage by sea. The kind of damages to be addressed by the convention would include loss of life and personal injury, loss or damage to property, as well as the loss or damage caused by the contamination of the marine environment. As envisioned to date, it would apply to packaged substances, as well as to the carriage of the residues and wastes of substances considered to be hazardous or noxious. However, there are outstanding questions on how to define the substances to be included in the convention, and the relation between the compensation limits to be established by the convention and the available third party liability insurance capacity in the open market.

143. The effectiveness of international agreements to prevent oil pollution by shipping may be judged by a study conducted in the United States on inputs of oil into the marine environment (United States Academy of Science/Marine Board of the National Research Council, 1989), which, among other things, concluded that total oil discharge had declined from 2,133,000 tons in 1971 to 568,800 tons by 1989. Although pollution caused by grounding or collision of large tankers causes severe local environmental damage, such inputs are comparatively small.

144. Reduction of the inputs of oil from shipping activities is mainly due to wide implementation of the rules and standards for prevention of operational discharges of oil from ships, contained in the first ever international agreement for the protection of the marine environment, OILPOL, 54, and its amendments, and MARPOL 73/78 which superseded OILPOL in 1983. Enforcement of pollution conventions is guaranteed by so-called non favourable treatment of non-Party ships and through the Port State control carried out by the United States, European and other countries. Under Port State control a certain percentage of foreign ships visiting their the port State are inspected to ensure that ships comply with the rules and regulations of various international agreements. Recent findings from Port State control authorities show that more than 90% of ships satisfy the Convention requirements.

145. In view of the recent EXXON VALDEZ and other incidents, IMO is reviewing the existing agreements to improve tanker construction standards as well as the problems of vessel operation which are the primary causes of more than 80% of maritime accidents. In the recently enacted US Oil Pollution Act of 1990, double hulled tankers have been mandated, with deadlines for the retirement of the existing tanker fleet beginning now until 2015, as well as state-of-the-art Vessel Traffic Schemes and other design, operational and manning requirements.

146. Accidents involving oil tankers, offshore oil and gas exploration, exploitation or production activities, storage and handling facilities and loss of hazardous chemicals at sea continue to occur notwithstanding improvements in design, construction operations and standards of training. The extent to which such accidents contribute significantly to the degradation of the overall health of the oceans is uncertain. There can be no doubt, however, as to the severity of the environmental and economic impacts and human health risks at the local level posed by a massive release of oil or other hazardous and noxious substances. Such accidents generally occur in near-shore areas which are known to be highly productive and environmentally sensitive. The risks of an oil or chemical tanker accident are not confined to high density maritime traffic routes; almost no country with a coastline is immune from the risk of pollution through such incidents.

147. Shipping-related wastes such as sewage, garbage and oily ballast waters, wastes from marine platforms such as drilling muds and incidental losses of nets and lines from fishing vessels all harm marine life. Accidental releases of substances and wastes have been responsible for some of the worst marine pollution incidents. Improper packaging, labelling and transport and poor maintenance of plant, equipment, treatment and disposal facilities are major factors in this regard. Accident prevention and response procedures are a necessary part of marine prevention efforts. These have been and continue to be, the focus of measures to combat marine pollution from shipping under the MARPOL Convention; they could usefully be extended to a number of land-based activities.

148. If the threats of a major marine pollution incident are to be avoided and the effects mitigated, there has to be in place a viable system of preparedness and response at the national, regional and global level. Each country could at least develop a national contingency plan and, to the extent feasible, the technical and administrative means by which resources can be mobilized to respond to a marine pollution incident. The ability of one or more countries to respond to such incidents can be enhanced through bilateral and regional co-operative agreements on early warning, reporting and mutual assistance.

149. There is wide recognition of the "polluter pays principle" and international regimes, both commercial and intergovernmental, exist to provide compensation for costs incurred in combating oil pollution incidents. However, what is currently lacking is a financial mechanism to provide the necessary resources to enable the countries which are exposed to the risk of a major marine pollution incident to prepare themselves for responding to such incidents. Many countries exposed to the risk of a major marine pollution disaster derive no direct economic benefit from the activity which creates the risk. Consideration of the principle of the "risk creator pays" could perhaps be explored as one option for providing such financing.

150. Coastal States adjacent to major oil and chemical trade routes which do not import or export large quantities of these substances have a strong basis for requesting assistance in developing their national systems for marine pollution preparedness and response. Currently, technical assistance and advice are provided to a limited extent through the United Nations system, e.g. IMO, UNEP, UNDP. Consideration needs to be given to the creation of a

mechanism or fund (with significant support from the oil industry) designed to support preventive measures and activities related to preparedness, including contingency planning, training, transfer of technology, equipment stockpiles, etc.

Policy Principles

151. The dominant approach to marine environmental protection over the past 20 years or more has been a combination of reliance on assumptions of the marine environment's "assimilative capacity" in conjunction with controls on inputs of substances and wastes that have harmful effects on marine life, resources and amenities. Generally, priority in marine pollution control has been to prevent toxic effects and physical interference with habitats and biological processes. As coastal waters have become increasingly degraded, though, there has been a shift in thinking towards the view that significant contamination by unnatural substances which have the property of dispersal and persistence in the marine environment could be prevented. Toxicity and bioaccumulation, whilst useful indicators of potential harm, cannot always serve as identifiers of harmful substances. As the Contracting Parties to the London Dumping Convention stated, "existing pollution control approaches, under the [LDC], have been strengthened by shifting the emphasis from a system of controlled dumping based on assumptions regarding the assimilative capacity of the oceans, to approaches based on precaution and prevention" (A/CONF.151/PC/31, Annex 1).

152. In this regard, numerous international forums have adopted revised "prevention of harm" policy statements, variously referred to as the "precautionary action" or "anticipatory and precautionary" approach, among others. As noted above, this shift has been away from the principles of assimilative capacity which have required both scientific evidence of significant environmental degradation or harm, as well as the demonstration of a causal link to a substance or activity, toward the principle of anticipatory action, which may require the first but not the second, and does not preclude acting even before the onset of damage if damage is thought likely. Appropriately, the principle of precautionary action: (1) appreciates the limits of scientific prediction, monitoring and control; (2) accepts that anticipatory action can and should be taken where sufficient grounds exist for concern, even in the absence of firm scientific proof of cause and effect; and (3) recognizes that resources must be put into clean production technology in order to ensure that harmful wastes are minimised.

153. As noted earlier, concern over the magnitude of contamination and uncertainties regarding its significance to the marine environment have stimulated the international community to adopt measures that reflect a more precautionary approach to managing contaminant inputs. This has occurred at both the global level (e.g., UNEP Governing Council, London Dumping Convention) and regional levels (e.g., North Sea Ministerial Conferences, Organization of African Unity, Paris and Oslo Commissions, Latin America and Caribbean's Tlatelolco Platform, and the Bergen ECE Conference).

154. Building on the precautionary approach, this has already resulted in regional initiatives to reduce substantially current inputs of priority contaminants such as nutrients, certain heavy metals and synthetic organic

substances from all sources (North Sea Conference, 1987) whether or not there is evidence that harmful effects have occurred. Similarly, the decisions within the Oslo Convention and the London Dumping Convention to phase out certain forms of dumping can be seen as further examples of the regulatory implementation of such an approach.

155. These actions constitute the basis of a precautionary approach to environmental contamination. While in principle they could be directed at all substances and wastes, in the initial stages of implementation, priority can be given to those materials which demonstrate a high degree of toxicity, which are persistent in environmental media, or which are liable to accumulate in biological tissues. There are many listings of hazardous substances which can assist in identifying substances that demand urgent attention from the responsible authorities. In the cases of certain synthetic organic substances with particularly harmful properties it is advisable to reduce emissions as close to zero as soon as possible.

156. Underlying global and regional actions which are serving to advance the precautionary approach is the view that greater attention could be given to all human activities that release substances or wastes and to progressively reduce the overall burden of contamination on the environment as a whole. In this regard, each of the international forums that has articulated the need for such an approach also has called for strengthened commitments to clean production technologies. Such technologies represent an improved, further development of the Best Available Technologies concept. Their primary advantage is that they ensure that pollution is eliminated and not transferred to another pathway or environmental medium. Moreover, but analyzing the entire production life cycle, including the ultimate fate of the product itself, clean production substitution is not restricted to technological fixes, but is broader. Through substitution with clean production methods, hazardous wastes and products entering the marine environment can be fully eliminated rather than creating a disposal problem.

157. There are many opportunities and practical possibilities to reduce environmental contamination. For existing practices, improved "housekeeping" and maintenance of equipment, up-grading of production processes and improved waste treatment can achieve substantial reductions in emissions. For new investments, careful attention to the choice of raw materials, energy requirements, the design of processes and waste treatment facilities, prior consideration of the opportunities for recycling and the constraints on waste disposal will assist movement towards cleaner technologies which minimize environmental impacts. With respect to "clean" production, a multitude of clean production experts, pilot projects, and case studies has developed over the past few years. The primary hurdle at present is the lack of industrial and political will to implement clean production methods, not a lack of physical or technical capability.

158. As regards the prevention of marine pollution by substances and wastes, a more specific goal is warranted that would serve as the basis for global action in controlling contaminant inputs, i.e., to manage human activities and human development in a manner that will prohibit or limit contamination of the marine environment, especially with respect to substances and wastes where there is reason to believe that damage or harmful effects are likely to be

caused, even where there is inadequate or inconclusive scientific evidence to prove a causal link between emissions and effects, and thereby to ensure that the viability of marine ecosystems and the legitimate uses of the sea are sustained for the benefit of present and future generations.

159. There are certain management approaches that could be adopted as components of national and international policies that aim to address the overall goal of marine environmental protection. Some important and entirely complementary approaches are as follows: the establishment of national agencies or institutions responsible for environmental planning; reduction of toxic and hazardous substances at the source, including requirements for waste reduction audits; the use of environmental impact assessments; adoption of a precautionary approach, including a strong commitment to clean production technologies; the polluter pays principle and the monitoring of the level and effects of marine pollution and the related scientific research.

160. The effectiveness of international agreements in preventing or reversing degradation of the marine environment depends entirely on the full and proper implementation and enforcement of the agreements by the governments concerned. Compliance with quantitative standards and targets can provide international bodies with useful measures of performance but it is not feasible to assign numerical values to all practices and environmental conditions. Nevertheless, this approach could be adopted whenever practical and appropriate.

161. Since intergovernmental litigation is seldom a satisfactory means to enforce compliance with international agreements, international bodies that deal with protection of the marine environment might consider the establishment of independent auditing bodies that would periodically evaluate the performance of States in complying with their international obligations. Alternatively, a single auditing body could be established at global level.

VII. IMPLICATIONS OF CLIMATE CHANGE IN OCEAN MANAGEMENT

Main Issues

162. The ocean has been referred to as "the flywheel of the climate system" since it stores energy in the form of heat when it is in plentiful supply during the day or summer and releases it when the supply is reduced during the night or winter. Ocean currents move thermal energy from the tropical and sub-tropical regions to higher latitudes thus moderating the climates on adjacent land masses. Any change to major ocean current systems could be expected to have major effects on regional climates, weather and on marine productivity. The inter-play between the ocean and the atmosphere involves several feed-back loops. Wind directions are determined in part by temperature differences between land and sea, and ocean surface currents are in turn affected by wind speed and direction. Increases in sea surface temperature will therefore alter the existing dynamic balance between ocean and atmosphere and current patterns at least on local and mesoscales. Increased ocean surface temperature will increase the rate of open water evaporation and cloud formation, which will in turn affect surface temperature.

163. On longer time scales other changes may be anticipated. In the tropical Atlantic, where solar heating and excess evaporation over precipitation and runoff occur, a body of warm saline water is created which moves northwards, losing heat to the atmosphere. In the area of the Greenland Sea the water now sinks as a body of cool, high salinity water and flows southwards as a deep water mass. The salinity of this water could be reduced by greater precipitation, by the Greenland ice cap melting or by the increased passage of Arctic water into the Atlantic. In that case cooling might be insufficient to increase the density of the water which would not sink. Extensive changes to the circulation patterns of the North Atlantic might occur, with major consequences for the climate of Western Europe.

164. The existence of basin scale oceanographic phenomena with major impacts on regional climates and sea levels is perhaps best known in the case of the El Nino Southern Oscillation (ENSO). During El Nino events the westerly moving, warm, surface ocean currents of the tropical Pacific dominate the northerly moving, cold, Humboldt current off the coast of Latin America. This results in major decline in off-shore oceanic production and dramatic decreases in the pelagic fisheries yield. In addition, sea levels rise by between 30 and 50 cms on the Latin American coast and are lowered in the western Pacific. Such changes in ocean circulation may be linked with periods of lowered rainfall in Australia and South East Asia. The need for better ocean observations to predict the onset of ENSO events has lead to development of a Pacific network and a number of large scale ocean experiments designed to understand the mechanisms controlling this phenomenon.

165. The role of the oceans in the global carbon cycle is still not well understood. Given that the oceanic sink of carbon is considerable, our lack of understanding concerning the oceanic fate and flux of carbon dioxide is a cause for concern. Productivity is not uniform throughout the oceans, open ocean areas are the watery equivalent of deserts. In zones of upwelling, where deep ocean reserves of nutrients are brought to the surface and in coastal zones where nutrient inputs are received from land, productivity is much higher. In tropical and sub-tropical regions primary productivity is generally limited by nutrients while at higher latitudes water temperature may limit primary productivity during the cold seasons. Ocean productivity varies on diurnal, seasonal, inter-annual, and decadal time scales. A considerable proportion of this variation is determined by climate, and is well documented, together with associated changes in fisheries production.

166. A number of factors unrelated to climatic change are known to affect climate. Volcanic eruptions producing dust clouds in the upper atmosphere or sulphur dioxide which forms droplets of sulphuric acid shield the surface of the earth and result in global cooling of several tenths of a degree. Such effects are short-lived and observations of atmospheric transparency suggest that volcanic eruptions have played little part in temperature trends over the last 100 years. Changes in the "solar constant" of 0.3-0.5% could cause a temperature increase equivalent to that observed over the last 100 years (0.5°C.). Satellite based measurements demonstrate that the sun brightness does indeed change on time scales as short as years and decades and that such changes correlate with changes in sunspot activity. The correlation between sunspot activity and average global temperature from 1885 to 1985 suggests that variation in solar radiation may be responsible for part of the post 1800 temperature rise.

167. The need for more detailed knowledge of the role of the ocean in determining global and regional climate patterns is obvious. Involvement of the Intergovernmental Oceanographic Commission and the Scientific Committee on Ocean Research/ICSU in the oceanic components of the World Climate Research Programme/ICSU-WMO is a response to the growing recognition of the role of the oceans in global climate. A number of activities, notably Joint Global Ocean Flux Study/ICSU, World Ocean Circulation Experiment and Global Energy of Water Experiment can be expected to identify elements for future ocean monitoring and observing systems. Present areas of uncertainty in climate modelling and prediction include aspects of the role of the ocean; the role of upper atmosphere water vapour and clouds; regional level prediction; and, the climatic influences of natural factors unrelated to greenhouse gases. Such areas of scientific uncertainty result in limitations to predictions of impact scenarios. Assuming that greenhouse gas concentrations continue to rise, some global warming may be expected during the next century, however the magnitude of the human induced greenhouse gas warming and the overall extent of the global changes which will occur are still ill-defined.

168. That global mean surface temperature has risen around 0.45°C including land and ocean, over the last century is now widely accepted. Similarly measurable increases in greenhouse gas concentration have occurred over the same time period, and recent evaluations of global sea-level change suggest that the current average rate of rise is approximately 1.5 mm yr-1. Whilst the similarity in trend between these three sets of observations supports the greenhouse theory, a causal relationship is not proven and the anthropogenic impacts on global climate remain a scientific hypothesis.

169. The Second World Climate Conference agreed that if no action is taken to reduce emissions of active gases, global warming could reach 2 - 5°C over the next century and that sea level could rise by 65 cm +/- 35 cm by the end of the next century. This rate of warming is unprecedented in the past 10,000 years. It is important to recognise that scientists can make predictions with any degree of confidence only in respect of global level mean temperature. Predictions concerning changes in wind patterns, rainfall, ocean currents, sea levels and other variables are being made, but these have a low level of confidence and differ considerably depending on the models used. As a consequence, impact assessment and forward planning are even more constrained.

170. Ocean observations are much less well developed than atmospheric observing systems. Existing global circulation models cannot adequately include the role of the oceans in making predictions of the earth's climate in the next century. The paucity of ocean observations has inhibited the development of single basin models and the value of data for regional climate prediction is severely limited. Data collection systems have patchy coverage and the Indian and Antarctic Oceans are data sparse areas. The need for more detailed knowledge of the role of the ocean in determining global climate and regional climatic patterns is obvious. A number of activities can be expected to identify elements for future ocean monitoring and observing systems, including parameters to be measured, and the distribution and frequency of measurements. A detailed description of these and particularly of the Global Ocean Observing System (GOOS) as a component of a Global Climate Observing System is included in document A/CONF.151/PC/70.

171. The social and economic consequences of such uncertainty are obvious. If decision makers take the lower bound they risk the consequences could worst case scenarios eventuate. Yet taking the upper bound conditions could lead to larger financial investments which may later prove to have been unnecessary. There is an imperative need to reduce the uncertainties. Acting today on current ocean and coastal zone environmental problems will mitigate them and this would represent an investment in sustainable development even if no climatic change occurs.

Impacts of Possible Climate Change on Small Islands and Archipelagic States

172. Recent assessments of climate change impacts on small islands include those conducted through the United Nations Environment Programme-Intergovernmental Oceanic Commission Regional Task Teams on climate change implications. The most comprehensive include studies of the Maldives, and of various Pacific and Caribbean Islands. For most small archipelagic states the entire land area may be considered "coastal" in that it is directly influenced by and influences the inshore waters. Few studies to date appear to have attempted a comparative ranking of the vulnerability of areas, regions or countries. One comparative algorithm for the islands of the Pacific Basin has been developed and used to identify priority countries within the region. Small archipelagic states are among the most vulnerable in the world to the potential impacts of climatic change and sea level rise. Delegates from small states to the second Preparatory Committee meeting of UNCED stressed the need to take immediate and effective action. The Ministerial meeting of fourteen small States, in Male' in 1989 amplified their needs and called on the United Nations and other International bodies to assist. To date thee response has been limited.

173. Whilst the potential impacts identified for coastal zones in general are equally applicable to small island nations, such countries are also subject to constraints and potential impacts which are unique or of greater magnitude than potential impacts in coastal states having higher altitudes and more extensive inland areas. The distinction between such "archipelagic" and 'coastal" states are already drawn within the United Nations Convention on the Law of the Sea (UNCLOS) and such states may merit particular consideration within the framework of future attempts at managing the global marine environment.

174. One critical and frequently limiting factor on small islands is the freshwater supply which is derived from rainfall stored in underground aquifers. Aquifers are small freshwater lenses floating on the seawater. Aquifer volumes reflect island area and the underlying geology and on many islands current supplies are already limiting development and agriculture. Higher sea level will ultimately reduce aquifer volumes thus reducing the carrying capacity of the island. For some island communities it could become necessary to depend on desalination for freshwater and this might be too expensive for many uses such as agriculture, increasing the dependance of the country on imported fossil fuels.

175. Small archipelagic states have limited land areas, close to sea-level. In atoll states such as Kiribati, the Marshall Islands, the Maldives and Tuvalu up to 80% of the land is less than 1m above sea level. In high islands most agricultural land is at or close to sea-level. Most infrastructure development including roads, airports and communication networks are coastal

in location, often flooded by spring high tides. A small rise in sea level may result in substantial losses in total land area; changes in stability pose threats to the continued existence of such islands. Coastal erosion is already a problem for many Pacific islands and this will be accentuated by sea level rise.

176. It has been suggested by the IPCC that since atolls survived past conditions of rising sea level they will keep pace with rising sea level. This has been questioned and it has been argued that not all coral reefs "kept-up" with past rising sea levels, some "gave- up" and some "caught-up" following initial inundation. The reasons why individual reefs responded in these different ways are unknown at the present time. A number of researchers have drawn attention to the increasing frequency of coral bleaching and mortality, apparently as a consequence of high temperature anomalies. Changes in corallivore populations apparently as a response to small scale changes in ocean circulation and higher water temperatures are known to have occurred in a number of reef systems. Many studies have clearly shown that coral reef systems are already stressed in many areas of the world as a consequence of human activity. Current and predicted changes could affect the ability of reef systems to respond to rising sea level and this undermines the view that all atoll islands will survive climatic changes and sea level rise.

177. Similar statements relating to the ability of marshes and mangroves to respond without significant change have also been made. Various studies suggest however, that mangroves will be unable to keep pace with rising sea levels unless allochthonous sediment inputs are increased; that wetlands soil chemistry may change such that peat reserves are depleted; and that certain ecotones of marsh communities may be disproportionately reduced in extent.

178. Any changes in the frequency, intensity or distribution of tropical cyclones or hurricanes could potentially have devastating effects on small island communities particularly where urbanization has formed aggregations of people on islands with restricted land areas and little or no high ground. The diversity of the terrestrial flora and fauna of islands is limited, although islands contain a disproportionate number of endemic species and species with restricted distributions. The high salinity, alkaline PH and low fertility of many island soils and limited freshwater limit agricultural potential. Changes in rainfall and temperature as a consequence of climatic change could further limit this potential. The eco-physiological tolerance of many tropical crops restricts the range of potential introductions which might be made.

179. Islands are home to a disproportionately large section of the worlds cultural and linguistic diversity with each island community having its own cultural traditions, scientific and traditional knowledge base. Over a third of the world's languages are spoken in the archipelagic countries of Melanesia and maintaining such cultural integrity would be impossible if such communities were relocated. Island communities are highly dependent on the marine environment and resources both for subsistence and commercial production. Their store of knowledge concerning the marine environment and its resources may be more detailed and sophisticated than that of western science. Any change to biological productivity within the areas of their Exclusive Economic Zones would have dramatic impacts on the capacity of such countries to achieve sustainable development. The ability of such fragile economies to respond to the constraints imposed by the need to adopt mitigation measures for climatic change impacts is severely limited.

180. Many smaller island countries in the tropics and sub-tropics are dependent upon tuna as a major source of export earnings. Climate change impacts on the distribution of such stocks may not be great. In contrast, the potential impacts on reef fish stocks are likely to be greater given predicted changes to coral reefs, threatening the basis of the subsistence economy. A major source of income for island countries is tourism, particularly associated with coral reefs. Any decline in the amenity value of reefs, beaches and climate following climatic change and sea level rise could reduce tourism related income.

181. The constraints imposed by small land areas, huge exclusive economic zones (land areas are generally less than 0.001% of the EEZ) and consequently large maritime distances separating population centres; small and narrow, marine based economies; all render the achievement of sustainable development in such states is a difficult task. The imposition of the added burden, of planning for and taking measures to mitigate the impacts of climatic change and sea level rise may place the achievement of sustainable development beyond the reach of many small island states. A further constraint to response on the part of small island states to potential impacts is the limited pool of scientific and technical expertise available to respond to the need for integrated coastal zone management and mitigation measures for potential future impacts.

182. Although the small island states have contributed little to the problem of global climatic change they are nevertheless the countries which are likely to feel the impacts first and potentially might be the worst affected. It cannot be stated categorically that any small state will cease to exist as a consequence of global climatic change and sea level rise, but the possibility that several states may become uninhabitable or completely unviable economically must be accepted. In the case of small islands two of the three response strategies advocated by the IPCC subgroup on coastal zone management, namely retreat and protection are not possible whilst the third, accommodation, might not be possible within the existing economic and environmental conditions. Transferring solutions and models from larger coastal countries to small islands will not work.

183. From the perspective of small island states therefore measures to slow or prevent sea level rise and climate change are viewed as a positive necessity. The need for international agreements to provide assistance in evaluation, monitoring, management and planning for environmental changes are of paramount importance. In the context of their endogenous capacity to respond to the present problems, small island countries must be considered as particularly disadvantaged and therefore in need of preferential treatment in the framework of any global agreements concerning this issue.

Impact of Possible Climatic Change on Vulnerable Coastal Areas and States

184. Climatic change impacts in coastal areas will be both diverse and extensive including alterations to physical, biological and human elements. More detailed understanding of the functioning of coastal systems is required to facilitate impact prediction, planning and management. The diversity of local environmental conditions compounds the difficulty of making accurate predictions on local scales. Most studies relating to global change impacts

in coastal areas have concentrated on the potential impacts of sea- level rise and have either neglected climatic parameters completely or socio-economic considerations. Attempts at developing policy directions have been based on generalizations of impacts rather than on specific analyses for particular countries or areas.

185. Numerous publications have been produced recently on global climate change impacts in the coastal zone including the report of Working Group of the IPCC and the reports of the UNEP, IOC regional task teams. Most reviews have listed broad areas of impact and few have considered the implications of several different scenarios with specified time frames, for the same geographic location. This has resulted in a lack of direct comparability between individual studies and assessments. The Regional Seas Task Team for the Mediterranean reviews on the impacts on agricultural, social and economic features of the region concluded that social and economic changes may outweigh the impacts of climatic changes in this region over the next 50 years. Similar, some conclusions were drawn by the regional task team for the South Pacific stating that a major impact on Papua New Guinea might well be the expansion of the region of endemic malaria into the central highlands. Such examples demonstrate the need for a co-ordinated and multi-disciplinary approach to impact assessment rather than a narrow sectoral approach. Potential impacts may be directly related to temperature and other components of climate, including episodic events, or to changes in sea level, or to the combined interaction between several such factors. Establishing whether observed changes result from global climate change or from other anthropogenic or natural causes will be a major challenge for the immediate future.

186. Predicted changes include: increased air and sea surface temperatures, changes to local climates and weather, changed patterns of winds and rainfall in time and space. On a local scale changes in air temperature cannot be predicted accurately since air temperatures will be affected by local topography and by changes in other local microclimatic parameters including rainfall and wind patterns. Regional, sub-regional and local changes in rainfall and wind patterns cannot be predicted accurately. Secondary impacts include changes in relative humidity, in run-off and river flow rates, in coastal soils and soil fertility, in distribution of coastal biomes, in coastal current and wave regimes, in the location and/or persistence of oceanic frontal systems, in salinity and coastal water chemistry, in the distribution, intensity and frequency of storms, in coastal flooding and changes in human comfort of specific locations.

187. Frequency of coastal flooding would be increased by a rise in sea-level, but would also be changed by alterations to coastal current regimes affecting wave climates, by changed storm patterns and by changes in rainfall which might enhance river based flooding in major river systems. It has been suggested that a general world-wide increase in inundation is likely and the impacts of such changes can only be moderated by correctly planned development of the coast based on an assessment of vulnerability in both the short and long-term. River flooding will be affected by changes in the temporal distribution and absolute volumes of rainfall and may be exacerbated or mitigated by anthropogenic activities within watersheds.

188. The inter-connections, feed-back loops and consequences of changes in single physical parameters mean that impacts cannot be assessed on a sectoral basis and a systems approach to untangling potential impacts is imperative. For example changes in rainfall and temperature will affect relative humidity which will alter evapo-transpiration rates hence affecting the hydrological cycle and local water balance. Such changes will affect coastal vegetation distribution and abundance which will in turn alter animal distribution and abundance and the overall productivity of natural and agricultural systems on land. These will also affect human drinking water supplies. Changes in salinity levels will change coastal marine ecosystems, fish production and mariculture.

189. For many coastal cities reliant at the present time on groundwater supplies, increasing sea levels will restrict the volumes of available freshwater and saline intrusion will increase. Changes to riverine and groundwater supplies of freshwater will alter sediment and nutrient inputs to coastal and near-shore areas and will change the salinity regimes of currently productive coastal marine ecosystems, with impacts in coastal vegetation, agriculture and soil fertility. Total global fisheries production is not expected to decline as a consequence of changes in global ocean circulation. However, at a local scale, as a consequence of changes in coastal water productivity, there could be important implications for established fisheries and the economies of whole countries which are currently dependent on development income from fisheries.

190. Coastal ecosystems are likely to suffer considerable impacts as a consequence of predicted changes. Coral reefs may be one such system. They are areas of high biodiversity, being the marine equivalent of tropical rainforests as a source of species, genetic and ecosystem diversity. The potential impacts of changes to coastal fisheries are well illustrated by changes along the Pacific Coast of Latin America, when raised coastal water temperatures occur during El Niño years. Demersal and coastal fish change abundance with warm water species replacing those normally characteristic of these fisheries. These phenomena place economic and technological strains on local fishing communities requiring adaptation of catch, processing and marketing technologies and knowledge of changed fishing grounds.

191. Understanding the nature of potential impacts at a local level requires data and models which describe the current local situation and detailed local level predictions of future climates. Given that regional climate predictions may not be available for one or more decades priority will need to be given to improving the state of knowledge concerning coastal zones at local, regional and global levels and to ensuring that compatible data acquisition and exchange systems are in place in time to feed appropriate data into the regional models as they are developed.

192. The consequences of sea-level rise are more likely to be experienced by less developed countries and include; increased frequency and extent of flooding; rearrangement of coastal unconsolidated sediments and soils; increased soil salinity in areas previously unaffected; changed wave climates; accelerated dune and beach erosion; upward and landward retreat of the boundary between freshwater and brackish waters; greater upstream intrusion of saltwater wedges; and changes to bank and wetland vegetation; changes in the

physical location of the terrestrial aquatic boundary; changes in coastal water clarity and circulation; and changes in sediment sink volumes. The magnitude of such changes is difficult to predict.

193. As a consequence of the primary impacts a variety of secondary impacts can be identified which include amongst others: changes in off-shore bottom profiles; changes in sediment and nutrient flux rate; changes in marine primary production; and changes in terrestrial (coastal) primary production. Changes of sediment levels in coastal waters may enhance primary production by increasing nutrient availability or reduce it by increasing turbidity. Any concurrent changes to the sediment inputs resulting from natural causes such as changed rainfall patterns, or anthropogenic influences via changes to land use in the catchment, and/or management of river flows would further alter this balance.

194. Such complex interactions and feedback loops make the predictions of physical changes to coastlines due solely to rising sea-level difficult if not impossible at the present time. Certain critical areas of impact resulting from second and higher order changes may be identified. For example changes in beach plan form will alter current and wave regimes and hence local patterns of erosion and deposition and distribution of sub-tidal substrate types. Changes to substrates will alter the distribution patterns of benthic organisms, while changes in coastal currents will alter recruitment patterns of benthic populations. Such changes alter vulnerability of the coastline to wave attack, flooding and inundation and thus affect capital investment in construction and the suitability of coastal areas for settlement.

195. Changes in nutrient levels in coastal waters will change marine based primary productivity and may change the frequency of harmful algal blooms impacting fish and shellfish resources, thereby affecting subsistence and commercial activities. Changes in marine primary production will affect energy flow to and standing stocks of, higher trophic levels including finfish for human consumption. These will alter the economic viability of living resource based activities by affecting commercially important species such as penaid prawns and shrimp. Variations in the salinity of coastal wetlands may also alter the distribution of human disease vectors, hence changing the epidemiology of vector borne disease.

196. In many coastal areas current economic and social activities are exacerbating an already critical situation. Potential impacts of climatic change and sea-level rise are over-shadowed in many areas by existing problems of environmental management and current environmentally unsound development practices will increase susceptibility to predicted global climatic change impacts. Some coastal states are particularly vulnerable, for example between 8 and 10 million people live within one metre above sea level in each of the unprotected river deltas of Bangladesh, Egypt and Vietnam. Major centres of population such as Sydney, Shangai, Louisiana, and Bangkok are particularly vulnerable. The ability of developing countries to respond to local or national threat is severely constrained by economic considerations.

197. In synthesis, seasonal and episodic inundation and flooding are already serious problems in many countries and these are apparently increasing in frequency. Increased investment in the coastal zone has increased

vulnerability to climatic change. Past planning in the fields of engineering, human settlement and development has assumed that climates are relatively "stable" and can be described in terms of mean conditions, and the frequency of occurrence of maximum or extreme events. The view that past climatic data provides a reliable guide to the future is no longer sound and planning must take account of trends of rising temperatures and sea levels.

198. All strategies for the protection, enhancement and sustainable use of the marine and coastal environment and resources could be based on comprehensive observations and a sound, scientifically based understanding of marine ecology, ocean processes and their interactions with the terrestrial and atmospheric systems. Such an approach requires a greatly increased level of international co- operation and investment in marine and ocean science, education and training. Global strategies to address the problems of the environment and development must be examined, formulated and established, taking account of the role of the ocean in climate and climatic change impacts on ecosystems, biodiversity, and human society. Strategies need to take account of the socio-economic constraints in poor nations and the links between socio-economic and cultural processes and the natural environment. A considerable investment must be made in ocean planning and management if sustainable development is to be more than an unachievable ideal.

199. Coastal and near-shore environments are currently under threat world-wide and enhanced investment in appropriate systems for managing these vital resources and reconciling conflicts must be made a priority. The application of environmentally sound management practices in coastal and ocean activities must be a cornerstone in strategies to safeguard the marine environment. Integrated coastal zone management should not be seen as a universal panacea. A new paradigm which reconciles economic and environmental interests is needed if the accelerated rate of environmental degradation is to be halted.

VIII. CAPACITY BUILDING

Main Issues

200. The accelerating problems of the marine environment and coastal zones are growing much faster than the capacity of most countries to assess and resolve them. Since the sea is a relatively inaccessible medium for humans, its observation and study requires special and often costly means. While the industrialised countries have made great strides in coastal modelling and in ocean science and technology, this progress has not been widely shared with developing countries. It is a matter of urgency in all coastal countries to build their capacity to address ocean and coastal issues, particularly in developing countries where the need to achieve sustainable use of available resources is essential for survival. That capability must include a technical, scientific, social and political understanding of the problems and the means and methodologies to develop and implement solutions. Several principles that underlie any international approach to capacity building are included in detail in document A/CONF.151/PC/53 entitled Transfer of Technology.

201. The type of capacity required could help to harmonise and advance environment and development. Reference is frequently made to the vast

opportunities and resources of the ocean for developing countries. However the development of ocean mineral resources has proved to be costly and technically complex. Most living resources are heavily exploited and impacts of pollution and intensive coastal development are now reducing the productive capacity of many marine resources. The challenge of sustainable development in the oceans, lies in finding ways to fit together the many, often conflicting uses of the oceans and coastal areas through comprehensive integrated planning, and the restoration or even improvement of the productivity of important marine resources and the efficiency of their use through careful management.

202. Building the capacity for sustainable ocean and coastal development is thus a complex process which will require a considerable and continuing effort by all countries. Each ocean has its peculiarities and there are enormous differences in the range of marine ecosystems and coastal areas. Therefore this effort must cover the full range from global through the regional to the national and local levels. Building the necessary capacities at each of these levels could be carefully co-ordinated and mutually reinforcing. In some instances the result will be new and valuable forms of development. In others, it will be the maintenance of important resources which would otherwise be degraded and lost. There is a need to develop capacities for a variety of complementary requirements, including:

(i) Research, resource assessments and monitoring to understandthe status and trends in resources, the state of pollution and the behaviour of natural systems;

(ii) the compilation of appropriate information and its interpretation and use, through tools such as data banks, geographic information systems (GIS) and environmental impact assessments (EIA); and

(iii) the establishment and application of management measures, especially legislation, regulations and enforcement mechanisms.

203. The most essential capacity is in human resources. Marine and coastal area environmental management requires research and monitoring by specialists in the appropriate sciences as well as managers able to combine scientific, economic, social and political considerations into plans and measures for integrated coastal zone and ocean management. Training to meet environmental requirements could include high level researchers, monitoring technicians, data analysts, all levels of the management structure concerned with marine and coastal problems, local extension agents and even the resource users themselves, such as fishermen and tourism operators. An enormous and sustained flow of scientific and technical advice and expertise is needed to develop endogenous technical and institutional capability in developing countries.

204. Environmental management frequently requires scientific infrastructure such as laboratories and other research facilities which presently do not exist in many poorer countries or, if they exist, are often not efficiently maintained and supported. Until countries are capable of obtaining and evaluating data on their own environment, it will be difficult for them to carry out effective management. Improvements in basic infrastructure will require a considerable capital investment and a commitment to provide adequate operating costs.

205. The provision of boats, ships, diving equipment and other means of access for research and management is a major requirement that is a significant problem for developing countries. Research vessels in particular represent significant capital and operating costs that are beyond the means of many countries. Some access to such facilities is being provided by co-ordinated international co- operation and assistance, and this could be extended.

206. Management infrastructure is crucial for many countries, especially developing countries, who are unable to assess the problems facing their coastal and marine environment or to plan and implement the rational use and protection of their resources. In particular, they lack the means to integrate coastal and marine use and environmental management in a single policy framework. Management of any major component of the environment requires the capacity to analyze data and statistics, to generate policy options and take management decisions based on the best data available, and to apply management measures and enforce them. Both adequate facilities and trained personnel must be available to do this. Again the problems of access to the marine and coastal environment make it more expensive to carry out surveillance and to take action against offenders of fisheries or pollution regulations. Patrol boats and aircraft may be necessary if a country's authority is to be enforced more than a short distance offshore. Modification of economic and fiscal measures such as taxes and fines may be important means for environmental management but require a legal framework and personnel to enforce the law.

Building for the long term

207. The ultimate objective of any process for building capacity is that such capacity becomes self-sustaining. Once there is a certain critical mass of trained people, administrative structures and facilities, it should be able to maintain itself. This requires an adequate national commitment which is sometimes lacking, particularly for the oceans. Until that critical mass is established in a nation or a region, continued outside assistance in the form of basic support will be necessary. Unfortunately, with the difficult economic situation in many countries, present financial support is insufficient even to maintain existing capacity.

208. Building a nation's capacity is inherently a lengthy process. It takes time to train people, and even longer for them to acquire mature experience. Establishing institutions and facilities and accumulating data are also processes that require sustained effort over a considerable period. Detailed knowledge of a local environment is not something that can be imported at will. Too many aid and development projects aim for short-term results; they must be fit into longer-term strategies with clear continuity.

209. Effective regional mechanisms are an important part of environmental management capacity both in dealing with regional problems and in reinforcing capacities at the national level. Such mechanisms, whether the UNEP Regional Seas Programmes or others such as the IOC regional subsidiary bodies or the FAO regional fisheries commissions and other regional fisheries bodies, need to be strengthened where they exist and extended to or established in other areas that would benefit from a regional approach. Certain regions and countries have special characteristics for which particular capacities must be

developed. Enclosed and semi-enclosed seas are especially vulnerable and must be managed as a single system through appropriate regional agreements.

210. The development and implementation of regional action plans by the Governments of a region also influences the national policies and priorities of each participating State as the state of the marine and coastal environment is assessed and specific problems are identified. The process itself results in strengthened national capacities to understand and deal with environmental problems by giving local experts more experience, building national institutions, and strengthening legislation and regulations. At the same time, the compilation of regional needs helps to attract donor support in a mutually-reinforcing process. Regions that have succeeded in establishing effective regional co-ordinating units or organizations have in general been the most successful, as such units improve communications within the region, respond more rapidly to Government requests, and assist in the effective implementation of activities. The existence of a strong regional capacity can compensate in part for weaknesses at the national level, particularly for smaller and poorer countries whose potential capacity is inherently limited.

Strengthening regulatory, administrative and institutional systems

211. Governmental structures need to be modified and integrated to give them the capacity to assess the problems facing the coastal and marine environment and to plan and implement the rational development and protection of marine and coastal resources. Personnel and facilities need to be brought together in effective institutional structures. Many options are available depending on national requirements and traditions. These can range from strong centralized national bodies through decentralized systems to reliance on local government or even traditional leaders and local users to implement environmental protection and management. The form that institutional systems take is less important than the development of the capacity and the assignment of responsibility in one form or another. Special efforts are therefore needed to present environmental data in forms that facilitate their full consideration in the decision-making process. This in turn will build the public support and political commitment without which progress is impossible.

212. While the United Nations Convention on the Law of the Sea provides a global framework and other international and regional conventions give useful legal support, much needs to be done to strengthen national legislation for the protection and sustainable management of marine and coastal areas which is often weak, fragmented or entirely lacking. States that have not yet ratified or acceded to the relevant conventions could do so and could adopt corresponding legislation to apply them at the national level. Many existing laws also reflect the lack of an integrated environmental approach to coastal and ocean management, and need to be supplemented or replaced by new laws. This will require a strengthened capacity to draft environmentally-appropriate national legislation.

213. Coastal area management is a complex field requiring the balancing of the strong and often conflicting development pressures along the coast with the requirements of a productive but vulnerable environment. Guidelines need to be developed to assist States to adopt appropriate measures for integrated coastal management. Planning tools such as geographic information systems and

coastal vulnerability maps can assist in this process. A wide range of technologies now exists to address marine and coastal problems. A capacity needs to be created in both the public and private sectors to select the technologies and approaches that will be both appropriate and cost-effective in local circumstances.

214. The complete integration of environment and development in the planning process is particularly important on islands with growing populations where both terrestrial and marine resources are limited and thus both the types of development and the total size of the population must respect the carrying capacity of the island system. Traditional knowledge of island resources and their management, where it exists, can be a useful guide to modern approaches. The lessons learned in developing sustainable island life-styles and planning processes will be useful for other societies which may also be reaching environmental limits.

215. National institutions such as universities, research institutes and development bodies can be strengthened through direct bilateral assistance projects or by "twinning" with developed country institutions which can arrange continuing exchanges of personnel and technical support for research projects. National institutions can also develop their capacity through participation in regional and international programmes. Contracts with developing country institutions for participation in research and monitoring programmes could include a capacity-building component.

216. There is often a lack of confidence in the capacity and experience of local experts in developing countries. The involvement of such experts in regional programmes, international meetings and co-operative activities can broaden their experience and strengthen their reputation in the eyes of decision makers. Preference could be given to using local or regional experts whenever possible. Training need to be interdisciplinary in marine affairs, with emphasis on the integration of all aspects of marine science. Agencies could complement national competence with training material, advisory services, and regional centres, particularly for small island countries. Wide diffusion of skills can be facilitated by networking, exchange of personnel between institutes, and by sea-going experience on research vessels. Different training programmes are required for scientists, technicians for monitoring, environmental managers, extension agents, teachers, journalists and resource users. Some effort is required to ensure that a mix of opportunities is available to meet all the manpower needs of a country or region.

217. While some countries and regions have a pool of trained marine scientists, others have little if any scientific establishment. Training of research scientists is a lengthy process and may have to be completed at overseas academic or research centres. There are already significant international programmes to build up the marine sciences in developing countries, including those co- ordinated by the Intergovernmental Oceanographic Commission' Committee for Training, Education and Mutual Assistance in Marine Sciences (TEMA), the United Nations Educational, Scientific and Cultural Organization Marine Science Training and Education Programme (TREDMAR), the Food and Agriculture Organization of the United Nations' Fisheries Bodies Working Groups on stock assessment and worldwide training programmes, and several bilateral initiatives. However,

even when there are scientists available, they have usually been trained in traditional disciplines and need to be introduced to the interdisciplinary approaches needed for effective environmental management. There is a need for both interdisciplinary and sectoral scientific expertise at the national level to support both environmental management and development objectives. Trained scientists are particularly subject to "brain drain" and special efforts are needed to provide them with suitable positions and support for their research if they are to contribute to the development process in their country of origin.

218. There is a growing need for technicians trained to operate routine environmental monitoring and assessment programmes. IOC is planning comprehensive regional training programmes on operational and applied research and monitoring, including the integrated use of marine data, and covering biological, physical and chemical sampling of near-shore and coastal waters, use of standardized techniques, statistical and mathematical analysis of data, integrated approaches to coastal zone management, use and analysis of remotely-sensed imagery, and Geographical Information Systems.

219. Environmental managers are required in both government service and the private sector. They could receive both some technical education and general management and administrative skills. This need could be met in part by adding some environmental courses to existing training programmes and university courses of study. Specialized programmes such as the World Maritime University and other institutions set up by IMO are also important and could be supported and expanded. Again special short courses or on-the-job training need to be arranged for those presently having to deal with marine and coastal environmental questions.

220. For groups such as school teachers and journalists who can do much to build public understanding and support, environmental courses could be included in existing training programmes, and special courses could be arranged for in-service training. The training capacity of countries or regions could be developed to maintain a flow of manpower for critical environmental management and development positions in the marine and coastal field. Thus as people advance to more responsible positions or go elsewhere, there will be replacements available. Training on site in the country concerned ensures that knowledge is adapted to local equipment and conditions and allows the programme to be tailored to the specific needs of the countries concerned.

221. Training is also necessary to promote informed dialogue between those who manage and those who use the environment. Thus decision-makers need to receive some background in ocean issues, and those involved in the marine transportation, fishing and coastal tourism industries could receive some training in the environmental dimensions of their work. Extension programmes need to bring basic environmental understanding to marine resource users such as fishermen and those collecting or using coastal resources. Women have an important role in coastal gleaning and other fisheries and need to be targeted in any training programme.

222. Participation of the public is important in marine and coastal environmental management, since it is generally the people at the local level,

such as fishermen and coastal residents, who are most sensitive to their environment, and who can thus provide feedback on changes in the environment and trends in resources to those responsible for management measures. Such data are critical to determine whether development is sustainable or whether controls or changes are needed. Feedback from the grass-roots is particularly valuable in countries that cannot afford more sophisticated monitoring programmes. Fisheries extension and coastal management programmes could be designed to collect such information.

223. In educational curricula, emphasis is required on the relevance and role of coastal areas and oceans as an essential element of the Earth's life support system, on the requirements for sustainable use of coastal and ocean resources, and on the advantages of their proper management. Coastal countries could include some material on the marine environment even at the primary school level, and enough in secondary curricula that even school leavers receive a basic understanding of coastal management issues, since many may go on to become coastal resource users. Some materials for this have already been prepared by UNESCO, FAO, UNEP and others, but they need to be more widely used. Participation of NGO's as well as public awareness campaigns are needed to reduce the present level of ignorance of the economic, social and environmental significance of coastal and marine resources and of the causes of their deterioration. Where indigenous peoples have traditional knowledge of their coastal environment and marine resources, they could be encouraged to maintain that knowledge and to consider how it can be applied to modern management problems.

Monitoring of environmental parameters and improved use of data

224. Up-to-date information on the state of coastal and marine resources is essential for sustainable development and environmental management. While full environmental research and monitoring systems require considerable scientific infrastructure, much can be done to provide basic data even where the means are limited. All coastal states need to develop the capability to monitor the state of their own environment.

225. International agreement is needed on standard techniques for monitoring important marine species and habitats such as coral reefs and mangroves. A combination of simple *in situ* survey techniques and remote sensing could allow adequate documentation of the state of such critical coastal environments and their change over time. Standard fishing surveys can provide continuing data on the state of fisheries resources. Simple continuous plankton recorders can be used along regular shipping routes to give good information on the status of plankton populations and such problems as eutrophication and red tides. The capacity to analyze, interpret and store such data will also need to be developed.

226. With the increasing levels of coastal pollution in much of the world, it is necessary to establish and maintain national or regional laboratories capable of analyzing the principal pollutants which may present a risk locally, including urban effluent, agricultural runoff and industrial wastes. Marine pollution sampling programmes can then determine where there are serious problems requiring control measures, and can measure the effectiveness of pollution controls that are applied. Keeping instrumentation in such

laboratories working and up-to-date requires careful planning and choice of instruments, continuing follow-up, and assistance with trade-ins or up-grades as methods and instrumentation improve. However regional or international technical support such as that provided by the IAEA International Laboratory of Marine Radioactivity in Monaco will be necessary to keep such laboratories functioning in developing countries and to maintain the quality of their results.

227. Feedback mechanisms are needed to assess the effectiveness of capacity building. For instance programmes for quality control of analyses of chemical contaminants can identify laboratories having problems and permit rapid remedial measures to maintain the quality of output and thus sustain the initial investment in capacity building.

228. Much data have been collected on most coastal and marine environments. However they are variable in quality, frequently old, and generally buried in reports or overseas depositories where they are unavailable to those who need them. These existing data could be used in a more efficient way, with emphasis on quality control, analysis and interpretation. In particular, they can be combined with recent monitoring data to measure the changes in environmental resources and conditions over time as a basis for determining the sustainable use of resources. Such analyses can give early warning of developing environmental problems or serious overuse or declines in resources that would threaten future development and human welfare if not corrected in time.

229. Existing mechanisms for information exchange such as the Aquatic Sciences and Fisheries Information System (ASFIS) and IODE could be designed to make a more effective use of the large volumes of information available. Whenever possible, these mechanisms need to be standardized using widely-available information processing technologies. They could be readily accessible and user oriented. Databases for both existing and new information need to be strengthened and consolidated. The collection of irrelevant "data" must be avoided: data could only be collected for specific and well-conceived purposes. This can be best assured by careful design of projects and inter-calibration programmes and by creation of data banks organized to meet the real needs of the users.

230. The development of international monitoring programmes such as those which will contribute to the Global Ocean Observing System (GOOS) will provide an additional source of internationally- calibrated data in support of national environmental planning and policy-making requirements for coastal and marine areas. For instance, the UNEP/IOC/WMO long-term monitoring programme for parameters related to climate change and sea-level rise in coastal and marine areas could be implemented as rapidly and as widely as possible. Data can be compiled in geographic information systems (GIS) or included in ocean maps or coastal vulnerability maps. The presentation of data in ways that make them accessible to decision makers is critical to their effective use for planning or early warning purposes.

231. Emergency response is an essential part of a capacity building strategy. No part of the coastal and marine environment is free of the risk of accidents involving the spillage of oil or other hazardous chemicals which could

seriously damage the environment. Large quantities of such materials are transported by sea and are stored in coastal facilities. Damage can be reduced if such spills are rapidly contained and removed, but this requires careful contingency planning, expensive equipment and trained personnel. Few countries can afford to maintain full preparations for unexpected but possible disastrous accidents. Many countries and regions have been assisted by IMO and UNEP to develop contingency plans and protocols on co-operation in the event of such accidents, but much still needs to be done to increase national and regional capacities to implement such plans and to keep them up to date.

International aid and co-operation

232. Bilateral or multilateral co-operative projects related to marine and coastal development or resource exploitation need to be an integral part of national development plans. The cost of strengthening national capabilities, including institutional structures, could also be considered as an integral part of project costs. Particular attention need to be paid to development of national environmental expertise to support such projects. Transfer of environmentally harmful and obsolete technologies must be avoided. However care must also be taken in selecting highly sophisticated technologies to avoid providing with equipment which may not be manageable due to lack of trained local staff or infrastructure. Long-term co-operation on technology transfer and on building the capacity to evaluate suitable technologies is essential.

233. International assistance programmes could be based on a proper understanding of local realities. The practices of donor and aid agencies need to take into account national aspirations, traditional and cultural values, and the realities of local possibilities and environmental constraints. Support could be provided for long enough to achieve effective capacity building; programmes undertaken within a framework of recipients capacity building strategy are preferable to short-term single-purpose interventions. Where only short-term assistance is provided, appropriate follow-up could be planned after the end of the project.

234. Finance is clearly needed at appropriate scales to catalyze the development of national capacities. International assistance and budgetary allocations from national and local budgets do not need to be the only source of funds available, however. Industries can be convinced to contribute to monitoring and protection measures related to their activities. The revenues from environmental fiscal measures can be allocated directly to environmental protection and monitoring. Some countries lack the foreign currency necessary for critical inputs to environmental research, monitoring and management projects. Even a small amount of assistance with its foreign currency component can make a big difference in the effectiveness of national activities.

235. New international sources of financial support are becoming available, including infrastructure support from the development banks, and the Global Environment Facility (GEF). The use of part of these funds for institutional capacity building will help to ensure the sustainability of development projects. Continuing sources of funding must be sought to assist in developing

and maintaining the necessary capacity in the poorest countries and in island areas where some subsidies will be essential to maintain protection, monitoring and management measures in the global interest.

International and regional agreements and action plans

236. Widespread participation needs to be encouraged in international and regional legal agreements that can often provide direct benefits to countries in the reinforcement of their national capacities. Technical assistance is frequently available to help in meeting obligations under such agreements. Regional action plans and co-ordinating mechanisms also provide the means for capacity building through co-operation among countries sharing similar problems and through achieving economies of scale in the development of regional facilities beyond the means of any one country. Regional structures can contribute to technology transfer and training. They build networks through which regional priorities and actions can be identified and implemented. Regional assessment and management is essential for enclosed and semi-enclosed seas. A regional approach is also necessary to study and if necessary manage the large-scale marine ecosystems that are found off most continental margins and that provide the basis for many productive fisheries.

237. There is presently insufficient institutional capability at the international level to help developing countries with environmental planning and management, training, institutional development and awareness building. The needs have grown much faster than the capacity to respond. Agencies frequently find themselves chasing after the same few overcommitted experts. Funding in relation to the need is totally inadequate. A major effort is therefore required to increase the number of experienced experts, particularly from developing countries, who can implement capacity- building activities, and to reinforce the institutional frameworks through which they can assist. Agencies and other organisations could exchange rosters of experts and could use on the job training to develop new experts with the required skills.

XIX. INTERNATIONAL INSTITUTIONS AND LEGAL INSTRUMENTS

Main Issues

238. In recent decades human use of the oceans has expanded remarkably. Rapid scientific and technological development and political change worldwide have intensified traditional fishing, shipping, and communications activities and advanced offshore minerals and energy development, mariculture, and widespread recreational use. Industrial and agricultural growth together with expanding human settlements, particularly in coastal areas, have impacted on marine coastal areas and produced mounting volumes of wastes, much of which has been discharged into coastal waters or disposed of offshore.

239. Since the late 1950s, and particularly in late 1960s, the international community has steadily developed international institutions and legal instruments in order to cope with these and other problems effecting the oceans and wastes areas. There exist now a number of global and regional institutions, both within and outside the United Nations system, as well as numerous global and regional instruments, some of which are binding and others non-binding, for the protection and preservation of the marine environment,

the development of coastal and ocean space and resources, as well as the conservation of marine species. Comprehensive lists of such institutions and instruments are found in the addenda to the background paper to be distributed in Working Group II.

240. The major elements of the present policy framework may be described as follows:

At the global level:

(i) The United Nations Convention on the Law of the Sea (not in force) comprehensively covers all marine issues, including protection of the marine environment and its living resources. This convention is backed up by a special institution (United Nations Office for Ocean Affairs and the Law of the Sea).

(ii) The London Dumping Convention (LDC), whose regulatory system has been progressively adapted to take account of the need to prohibit or restrict dumping of toxic substances and wastes and to promote comprehensive waste reduction and management policies. Secretariat support is furnished by IMO;

(iii) MARPOL 73/78 on ship-source pollution, and other IMO conventions and codes dealing with maritime safety but contributing also to pollution prevention, most recently the 1990 Convention on Oil Pollution Preparedness, Response and Cooperation. Civil liability regimes have been developed for oil pollution damage, and work is well underway on a regime for hazardous and noxious substances (HNS). Secretariat support is furnished by IMO;

(iv) The Basel Convention on Transboundary Movement of Hazardous Wastes (not in force), which concerns also the maritime transport and disposal of wastes. Work is underway to harmonize its regime with those of LDC, MARPOL and other IMO Conventions and Codes, and to develop a liability regime. UNEP has established an interim secretariat;

(v) Conventions which deal with or otherwise encompass the protection of marine species, particularly the International Whaling Convention and the Bonn Convention on migratory species, which focus on marine mammals. These conventions are administered by independent secretariats. Also to be noted are the 1986 IAEA Conventions on liability and nuclear accidents.

At the regional level:

(i) UNEP Regional Seas conventions covering the Mediterranean, Kuwait Action Plan Region, Wider Caribbean, West and Central Africa, Eastern Africa, Red Sea and Gulf of Aden, South Pacific, and South-East Pacific. These are general conventions on the protection of the marine environment, analogous to Part XII of the Convention on the Law of the Sea, and are supplemented by a total of 19 protocols on ocean dumping (2), land-based sources (3), offshore industrial activities (1), emergency response to pollution incidents (8), radioactive pollution (1), and protected areas and species (4). Secretariat arrangements, linked to other activities under a Regional Seas Action Plan, are made by the regions concerned, supported to varying degrees by UNEP. Non-United Nations system organizations are also sponsors of these instruments and their institutional arrangements, e.g. the South Pacific Forum and CPPS.

Institutional support also is provided by IMO for the establishment and operation of emergency response centres. Regional programs in the East Asian and South Asian regions are in the process of developing conventions, and UNEP is exploring the possible development of action plans for the Black Sea, the North West Pacific, and the South West Atlantic;

(ii) Five conventions in the European region: the Oslo Convention on ocean dumping, the Paris Convention on land-based sources (extended by amendment to encompass atmospheric sources), and the Bonn Agreements on the North Sea (1983 Agreement not yet in force), all of which reach into the North Atlantic; the Helsinki Convention, dealing with all sources of marine pollution, which covers the Baltic Sea; and the 1991 Convention on Environmental Impact Assessment in a Transboundary Context (not in force). The Oslo, Paris and Helsinki Conventions established Commissions, which regularly report on their activities to LDC and MARPOL parties at IMO meetings. The Oslo and Paris Commissions hold joint meetings and are considering merging; and

(iii) Instruments covering the polar regions: In the Arctic, only a convention on polar bears; under the Antarctic Treaty, a protocol has been prepared that consolidates and strengthens the measures for environmental protection adopted under that Treaty and extends them to all Antarctic activities, while also subjecting minerals development to at least a fifty-year prohibition. This [draft] protocol will not affect rights and obligations under other Antarctic conventions in force, currently those on protection of seals (CCAS) and conservation of marine living resources (CCAMLR). A permanent secretariat has been established only for CCAMLR.

241. Thus, it is apparent that, with the exception of global conventions dealing with pollution from ships, ocean dumping and protection of marine species, the operational context for marine environmental conservation resides at the regional level.

The United Nations Convention on the Law of the Sea

242. The proliferation of regional agreements and arrangements makes it extremely important to consider the role of the Convention on the Law of the Sea in establishing a comprehensive, global framework. That framework governs the further development of legal and policy instruments at global, regional, and national levels. Increasingly, it is a framework for programming in global and regional institutions to further understanding of the ocean environment and to create co-operative efforts to build national capacities - both to benefit from marine use and to support implementation and enforcement of applicable laws and standards.

243. The Convention establishes an important balance between the rights of States and their obligations, including those relating to conservation of the marine environment and its living resources and the promotion of marine scientific research. The basic principles and rules represent prevailing international law demonstrated by State practice over the past 10 years, or more. The vast majority of States have adopted legislation which largely conforms with the provisions of the Convention, and most global and regional instruments drafted since the mid- to late-1970s have been careful to ensure conformity with its provisions.

244. In both its provisions on the marine environment and on living resources, the Convention emphasizes the need for a sound scientific basis for regulatory and management systems. It further calls on States to promote and facilitate the development and conduct of marine scientific research, as well as environmental assessment and monitoring. The Convention specifically calls for the continuous elaboration of international rules, standards, and recommended practices and procedures for marine environmental protection. The Convention specifically promotes the development and transfer of marine technology and the establishment of national and regional marine science and technology centres, particularly in developing countries.

245. With respect to marine living resources, the Convention grants sovereign rights to coastal States over fisheries within the EEZ and obligates them to conserve these resources so that they are not endangered by over-exploitation. Consistent with obligations to protect and preserve the marine environment, States must take measures necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened, or endangered species and other forms of marine life. On the high seas, fishing rights are also subject to obligations to conserve the resources.

246. The Convention also assumes a continuing need heightened international co-operation on ocean issues, recognizing also the future impacts of expanded uses of ocean space and its resources. To further cooperation, the General Assembly has urged competent international organizations to intensify and coordinate financial, technological, organizational, and managerial assistance for developing country efforts to realize the benefits established by the Convention (A/RES/45/145).

247. Finally, recognizing the dynamic nature of the implementation of the Convention, and that continuing scientific research and technological innovation, would need to be reflected in this on-going process, the Convention provides for a general review mechanism, whereby the Secretary-General is required to report "on issues of a general nature" that arise in relation to the Convention. The annual overview of main developments relating to the Law of the Sea, prepared for the consideration of the General Assembly (in plenary), represents an early form of this reporting function.

Opportunities and deficiencies in the present framework and possible approaches

248. In order to cope with the range of increasing demands on international institutions to support sustainable ocean use, it may be useful to examine several aspects of their functioning in the areas of strategic planning and policy development and implementation. The need to appreciate the range of global and regional organizations involved in marine programs required the preparation of a directory on organizational competencies during UNCLOS III. Today the number and scope of such programs is even greater. In addition, the roles of the major funding agencies must be specifically addressed.

249. Improved mechanisms for strategic planning and the identification of priorities for legal and institutional initiatives relating to different sectors of ocean activity and the broader range of land-based activities that affect sustainable ocean use are necessary at national, regional, and global levels.

250. Within national governments, innovations are required to reconcile sectoral considerations in the formulation and implementation of national development policies. At the regional level, there is considerable scope for cost-effective, coordinated action on ocean and coastal development and management. For this purpose it will be important to establish an oceans-centred forum to define those issues and priorities that will justify the closer integration of institutional and financial capacities, and enhance development assistance possibilities. At the global level, strategic planning could be oriented, in the context of development generally, toward the identification of priorities for major new initiatives, allocation of program responsibilities among different agencies and programmes, and related budgeting considerations. Strategies could also entail review of intra- and inter-regional arrangements and gaps, both within and outside the United Nations system. Regular review and evaluation might take place in relation to stated goals and targets, subject to periodic external review.

251. The tendency to create new organizational arrangements, pursuant to the adoption of additional conventions or as a result of brief, heightened attention to certain topics, could be re- examined in view of the reluctance of many governments to embark on new institutional initiatives. Greater attention could be paid to the viability of reorienting and strengthening existing structures as new priorities emerge. The consolidation of certain legal regimes also warrants attention, as both countries and international institutions experience difficulties in dealing with an increasingly complex and inter-related array of such regimes.

252. Consideration could also be given to reviewing institutional support arrangements relating to the provision of scientific and technical advice and analyses, and related data and information needs. Emphasis on scientific evidence as the basis for regulatory and management decisions, and therefore on improved scientific and technical capabilities, will continue to intensify with environmental degradation and overfishing. Progressive legal developments that increasingly specify standards and criteria for ocean use, including those for impact assessment, and further definition of the "precautionary principle" and "burden of proof" requirements will place even greater demands on data collection and analysis.

253. Within the United Nations system, interorganizational consultation and collaboration is well-established in the marine science and services sector, through ICSPRO and in respect of a growing number of jointly sponsored programmes and expert groups. GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Pollution) is expanding its advisory capacity through networking arrangements with a wider range of scientists and managers working in this field. Additional collaboration at the regional and interregional levels is needed, with attention to building national scientific and technological capabilities.

254. There are very few formal arrangements for ensuring scientific input in the preparation and implementation of legal agreements or important policy decisions. Establishment of or access to appropriate mechanisms will become increasingly important, particularly to ensure that scientist and policy makers can communicate effectively in identifying and meeting the specific needs of policymakers for analysis and advice. In some cases, ad hoc expert

groups have been established to prepare for and provide advice in the implementation of legal agreements. In other cases, existing organizations have been utilized, both governmental and non-governmental.

255. The involvement of multilateral and bilateral donors is essential in providing resources to achieve sustainable ocean development. Many failures in the past can be attributed to inadequate attention to incompatible activities or their effects on environmentally-sound development. It is essential that funding for environmental planning and management precede project funding, and that on-going planning processes provide a basis for focused, coordinated donor activities, based on priorities defined at global, regional, and national levels. Donor coordination is an essential condition, and is perhaps most urgently needed at the regional level.

256. The basic global framework for sustainable ocean use and development exists. Major future developments are likely to occur at the regional level, particularly in relation to land-based and atmospheric pollution of the marine environment and fisheries management. On the other hand, the need at the global level for more specific standards and interpretive guidance to implement existing legal obligations is growing, as is the need for harmonization among the standards and requirements applied in different countries.

257. Until the development of binding legal obligations in specified areas attracts widespread acceptance at regional or global levels, recourse to non-binding "soft law" instruments much as codes or guide-lines, is likely to guide further developments. Greater emphasis will be placed on preventive measures and incentives, as opposed to traditional regulatory approaches. At the same time, as codes and guidelines take the form of legal obligations, they are more likely to be supported by commitments of financial and technical assistance to assist all states in fulfilling them. It is therefore essential that the international community consider priorities for the elaboration of "soft law" and binding legal instruments, whether at global or regional levels, so that the allocation of resources for these purposes may then take place on a more reasoned and deliberate basis.

258. The Law of the Sea Convention contains many principles and rules that may be used as a basis for elaborating more detailed guidance, both in international and national law as well as in guidelines, codes, and other interpretive statements. A summary list is given in the Appendix. The need to examine the implications of the Convention for other global and regional legal instruments remains fundamentally important. As a framework for programs designed to meet the needs of developing countries, additional principles and provisions are set forth in the Convention that contemplate specialized global and regional arrangements to mobilize international cooperation and assistance.

259. <u>High seas fishing activities</u>: This is clearly an area where the principles and rules of international law (contained in the Law of the Sea Convention) require further elaboration in order to achieve sustainable use of resources. It may prove necessary to formulate guidelines and criteria for conservation of species, particularly to ensure that management decisions are grounded on credible and sufficient scientific evidence that can command

widespread international support. Also important will be new measures aimed at encouraging compliance with legal obligations, such as observer schemes, vessel registries (as in the South Pacific), notification and reporting requirements. Introducing institutional review functions and recourse to expert advisory bodies to weigh scientific evidence could also be considered, as could the introduction of dispute settlement mechanisms, e.g. by provisionally applying the relevant provisions of the Law of the Sea Convention.

260. Marine biodiversity: Protection of marine biodiversity will require substantial and multidisciplinary scientific input, and would benefit from the elaboration of rules and criteria for standard-setting. The new convention being prepared on the protection of biological diversity needs to take account of the special characteristics of marine biodiversity.

261. Climate change: The new convention being prepared in relation to climate change needs to take into account the special considerations and needs that arise in relation to potential sea- level rise and the obligations established by the Law of the Sea Convention concerning cooperative oceanic research, given the central role the oceans play in determining climate.

262. Protected areas: The development of rules and standards in this field is sufficiently advanced to consider taking up the process of their integration with other areas, particularly conservation and management of fisheries and maintenance of biodiversity.

263. Land-based and atmospheric sources of marine pollution: This is the most important area for development of global and regional ocean law and policy in Europe. That most marine environmental degradation originates from land-based and atmospheric sources lends weight to the obligation not to transfer or transform pollution and to the need to introduce policies and methodologies which will facilitate the introduction of comprehensive waste reduction and management systems at the national level.

264. Land-based sources of marine pollution are generally described in the Convention as including "rivers, estuaries, pipelines and outfall structures". The sources are extensive and through run-off include urban, industrial, and agricultural uses, both coastal and inland. This suggests a certain methodology: direct point sources; and rivers. The latter brings into play a distinct area of international law, namely that of international watercourses, which can be expanded to include at least an estuarine component.

265. Additional developments affecting control of land-based and atmospheric sources of marine pollution are subsumed within the context of "global climate" and "protection of the atmosphere"; under new or emerging programming initiatives concerning sewage treatment and port waste reception facilities; in relation to continuing work on environmental impact assessment and the establishment of protected areas; and as considered in relation to coastal zone management.

266. Offshore industrial development: The adoption of more detailed rules and standards in this area would seem most appropriate at a regional level at present. However, highly useful work can be done at the global level to

further develop and integrate existing rules concerning safety, removal and disposal of offshore structures; use of hazardous substances; operational discharges, assessment and monitoring; contingency planning and emergency response; environmental impact assessment; and a liability regime for marine environmental damage.

267. Offshore pipelines and seabed cables: Further attention may have to be paid to the regulation of pipelines and cables laid on the seabed as well as their protection as such pipelines proliferate in certain areas and the quality of cables become increasingly sophisticated.

268. Emergency response: Specific linkages could be developed between the 1990 Convention on Oil Pollution Preparedness and Response and regional protocols on emergency response, including pollution from offshore resources development, since the new convention applies to offshore platforms. Clear, uniform procedures for notification and exchange of information on such emergencies could usefully be developed. Moreover, greater use could be made of the 1989 Salvage Convention. Existing arrangements deal, in practice, only with oil pollution, although several regional protocols are intended to cover emergencies also from "other harmful substances". A major effort will be required to develop international cooperation with respect to incidents involving liquid chemical spillages, for example.

269. Emergency response capabilities are very much dependent on contingency planning, but it is difficult to plan or to respond efficiently without being able to target priority areas. IMO and others have called for a major effort on coastal sensitivity mapping, an activity which relates to the establishment of protected areas, the designation of "particularly sensitive sea areas" and to environmental planning and management for sustainable ocean use generally. Another area that deserves attention is the international co-operation in the maritime search and rescue operations.

270. Environmental impact assessment and environmental monitoring: This established obligation represents the first building-block in many regulatory and management regimes. Its particular importance in a transboundary context is clear, and the 1991 Convention (UN/ECE region) on this subject could be considered carefully as a possible precedent for other areas of the world, particularly with respect to advance notification and consultation. At the same time, the need for simplified approaches to EIA in developing countries, has already been recognized by UNEP, which has recently published a practical guide, supplemented by case studies.

271. An organized system for the exchange of and access to national legislation and institutional arrangements to implement treaty obligations would provide assistance to governments in developing legislative and administrative rules. It would also facilitate the tasks of international institutions whose advice and assistance is requested by States on such legal matters. The demands for such assistance has greatly increased, and bilateral aid agencies have also begun to devote resources to these needs.

272. As international legal obligations expand, keeping up with relevant technological innovations and scientific research findings relevant to their implementation requires more time and effort. An efficient system for

compiling and interpreting information must be found, accessed through a central system such as the international institution responsible for secretariat functions under the agreement. Cost-effective networks must be established through computerized information systems, which could service more than one agreement.

273. Establishment of regional focal points could serve many useful purposes: they can, among others, adapt global rules and standards as well as technical methodologies to regional conditions; stimulate and contribute to their development; serve as forums for considering transboundary and inter-sectoral considerations within logical geographic units, and for harmonizing regional policies and laws. Moreover, when economies of scale exist, they may provide a useful forum for concentrating education and training programmes, specialized documentation centres on marine technologies or experts availability, the development of interdisciplinary environmental programmes, and related data collection and analysis on regional trends and conditions.

274. Certain types of operational activities may also benefit from regional arrangements, such as surveillance, inspection, and enforcement or collective negotiation with States outside the region. It has also been suggested that regional waste reception or waste treatment facilities may be appropriate in certain circumstances. Regional fisheries management arrangements are also evolving and likely to increase in the future. In relation to securing financial assistance, proposals have been made for regional planning and investment.

275. Traditionally, action plans in the marine area have served the important purpose of bringing together and building support among regional constituencies as a basis for further legal, scientific, institutional, and financial developments. These action plans must be revitalized and strengthened in several regions and establish agreed strategies, particularly those dealing with fisheries research, development and management and those with marine and coastal environmental management, as well as scientific research and data and information exchange components. This would in turn require extended arrangements, particularly as among UNEP, FAO and IOC.

276. Equally important is the need to greatly expand inter-regional cooperation in order to capitalize on exchange of information and experience.

277. Compliance and enforcement: The first step in determining the extent of compliance with legal agreements is better information. Although a number of conventions require notification and reporting by States parties, these requirements are not being fully implemented and so create further impediments in amassing the information needed to identify and tackle problems

278. Liability: Issues of international liability, including compensation in some instances, have achieved new prominence and important legal developments can be expected. Current approaches would give equal weight to preventing transboundary harm and to reparations for damage. The work of the International Law Commission (United Nations) could also be noted. The further

development of liability regimes will also depend considerably on elaboration of the principle - "the polluter pays", "user pay" principles and the "precautionary approach", and on-going work in environmental economics to "value" environmental considerations.

279. Dispute settlement: The role of experts, as contemplated in the Law of the Sea Convention's special arbitration procedures, and in an advisory capacity could be explored for adaptation to other ocean use conflicts, particularly at the regional level.

280. Facilitating acceptance: Use of different legal techniques to facilitate and expedite acceptance and entry into force of legal agreements could be expanded. Flexible approaches employed in IMO allow States to ratify basic treaty provisions while leaving it up to them to determine later whether or when to ratify certain optional annexes. Other methods include provisional application of some or all treaty provisions (including those with institutional implications); simultaneous adoption of recommendations which deal with selected convention subjects; and declarations of voluntary compliance. A "tacit acceptance procedure" is also used in IMO to bring into effect revised regulations in detailed annexes without resort to time-consuming ratification procedures.

Appendix

Main Principles and Rules for the Development of Future Legal Instruments as contained in the United Nations Convention on the Law of the Sea

Sustainable ocean development and the protection of the marine environment

1. Avoidance of transboundary pollution (articles 194(2), 195 and 198);
2. Conservation and management of transboundary marine resources (articles 63, 64, 66(4), 67(3), 116-119);
3. Conduct of environmental impact assessment and monitoring (articles 204 to 206);
4. Establishment of scientific criteria for regulation and management to protect the marine environment (article 201);
5. Protection of rare or fragile ecosystems and habitats of depleted, threatened or endangered marine life (article 194(5));
6. Designation of marine protected areas (articles 194(5) and 211(6);
7. Caution in the use of technology or the introduction of new or alien species into the marine environment (article 196);
8. Use of "best practicable means" in controlling marine pollution (article 194(1));
9. Avoidance of pollution by toxic, harmful or noxious substances (articles 23, 194(3), 207(5));
10. Multi-media management of pollution and wastes, where States must avoid transferring, directly or indirectly, damage or hazards from one area to another and transforming one type of pollution into another (article 195);
11. Conservation based on ecosystem management (articles 61(4), 119(1)(b), 194(5));
12. Control of land-based and sources of pollution (articles 207 and 212);
13. Development of joint contingency planning and emergency response systems (articles 199 and 202(b);
14. Development of liability and compensation for marine pollution damages (article 235);
15. Regional harmonization of environmental policies, development of standards, and adoption of cooperative measures (articles 197, 207, 208, 210, 212, 270, 272, 276-77); and
16. Co-ordination of States actions on the environment, fisheries and marine scientific research in enclosed and semi-enclosed seas (articles 122 and 123).

Development assistance and cooperation

1. Promotion and facilitation of marine scientific research and the development and transfer of marine technology (Parts XIII and XIV generally);
2. International exchange of information and data (articles 119(1), 242(2), 244, 249);
3. For the protection of the marine environment, the level of capability of developing nations is to be taken into account (articles 194(1), 199 and 207(4));
4. Also for the protection of the marine environment, scientific and technical assistance is to be provided for developing nations (article 202), and their preferential treatment by international agencies is specified (article 203).

List of References

Working papers prepared for UNCED:

Coastal Areas Development and Enclosed Seas, prepared by FAO.

Control of Land-based Sources of Pollution, prepared by The Canadian Government and UNEP.

Global Ocean Observing System, prepared by IOC.

Impacts of Climate Change, prepared by IOC.

International Institutions and Legal Instruments, prepared by UN/OALOS and WRI.

Living Marine Resources, prepared by FAO.

Marine Pollution Control Strategies, prepared by IMO.

Mechanisms for Capacity Building, prepared by UNEP.

Response to Specific Questions Posed by The UNCED Working Group on Oceans, prepared by the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP).

Other references:

ACOPS., 1991. (Draft) Land-Based Sources of Marine Pollution. A Multidisciplinary Study by The Advisory Committee on Protection of the Sea (ACOPS) : 142 pp.

Antarctic Environmental Protection Strategy., 1991.

CCAMLR., 1991. CCAMLR Ecosystem Monitoring Program. Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

Conservation Measures/XIX.1990. Schedulde of conservation Measures in Force.

Conservation of Arctic Living Resources . Consultative Meeting for the Protection of Arctic Environment. Rovaniemi 20-26 september, 1989.

Convention on the Conservation of Antarctic Marine Living Resources.

FAO., 1991. (Draft) The Role of Women in Fisheries Development. Committee on Fisheries. Nineteenth Session, Rome, 8-12 april.

FAO., 1991. Environment and Sustainability in Fisheries. Committee on Fisheries. Nineteenth session. Rome, 8-12 April.

FAO Fisheries Report., 1990. Report of the third session of the Sub-Committee on Fish Trade. Rome 4-7 september, 56 pp.

Friends of the Earth., 1991. Hearing on Arctic and Antarctic Issues. Statement of James N. Barnes before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation.

Greenpeace International., 1990. (Draft) A document for Consideration by the Secretary-General in the Preparation for the Second Committee of the UNCED.

Griffiths, F. and Young, Oran R., 1990. Protecting the Artic's Environment. Working Group on Arctic International Relations. Third Session.

Guidelines., 1988. Women in Fishing Communities : A special target group of development projects. FAO.

Heininen, Lassi., 1990. (Ed.) Arctic Environmental Problems. Tampere Peace Research Institute. Occasional Papers No. 41.

Holt Sidney and Carlson Carole., 1991. Implementation of a Revised Management Procedure for Commercial Whaling. International Fund for Animal Welfare. England: 52 pp.

International Conference on Environmental Protection in the Arctic., 1989. (Draft) Background Information.

International Indigenous Commission., 1991. (Draft) Recommendations and contributions to Unced, prepared by the Argentinien Indigenous Leaders, Working Group held in Buenos Aires from May 20 to 24.

International Indigenous Commission., 1991. (Draft) Recommendations for PREPCOM III documents.

International Indigenous Commission., 1991. (Draft) Recommendations for IIC Documents- PREPCOM III.

IOC., 1991. (Draft) Strategies for the Protection and Development of the Oceans and Coastal areas. Paris.

Jommo, B. Rosemary., 1991. (Draft) African Women's Indigenous Knowledge in the Management of Natural Resources. Symposium on "Women and Children First".

Juda, L. 1987. "The Exclusive Economic Zone and Ocean Management", Ocean Development and International Law, Volume 18, Number 3.

Juda, L. and Burroughs R. H. 1990. "The Prospects for Comprehensive Ocean Management". Marine Policy, Butterworth & Co (Publishers) Ltd.

Merrikin, P. (comp.)., 1990. Women in fisheries. A selective annotated bibliography. FAO Fisheries Circular, No. 811, Rev. 1. Rome, FAO, 37 pp.

Preliminary Proposal for a Workshop on Women and Children entitled "Women and Children First". (Draft).

Protocol to the Antarctic Treaty on Environmental Protection.

Roiko, Leena., 1990. (Ed.) Legal Problems in the Arctic Regions. Institute for Nordic Law at the University of Lapland.

Samson, R. Paul., 1991. (Draft) International Environmental Co-operation in the Arctic. The Graduate Institute of International Studies. Geneva.

Scientific Commission of the International Scientific Symposium on Research and Small Scale Fisheries., 1989. (Draft) Note about Small Scale Fisheries. France, : 6 pp.

Stromberg, J. O. et al., 1990. State of the marine environment in Antarctica. UNEP Regional Seas Reports and Studies No. 129.

The Nairobi Forward-Looking Strategies for the Advancement of Women., 1985. UNEP., 1988. Marine Mammals Plan of Action: Evaluation of its Development and Achievements. UNEP Regional Seas Report and Studies No. 102, UNEP.

United States Background Papers to the 1991 Geneva PrepCom on Marine Pollution, Living Marine Resources, Coastal Zone Management and Data and Information Requirements, including Monitoring.

Weatherly, Richard., 1991. Conserving Antarctic Marine Life. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) : 22 pp.

Women in Fisheries. FAO.

Women in Fish Production. FAO.

Women in Fisheries., 1985. Economic and Social Commission for Asia and the Pacific. United Nations.

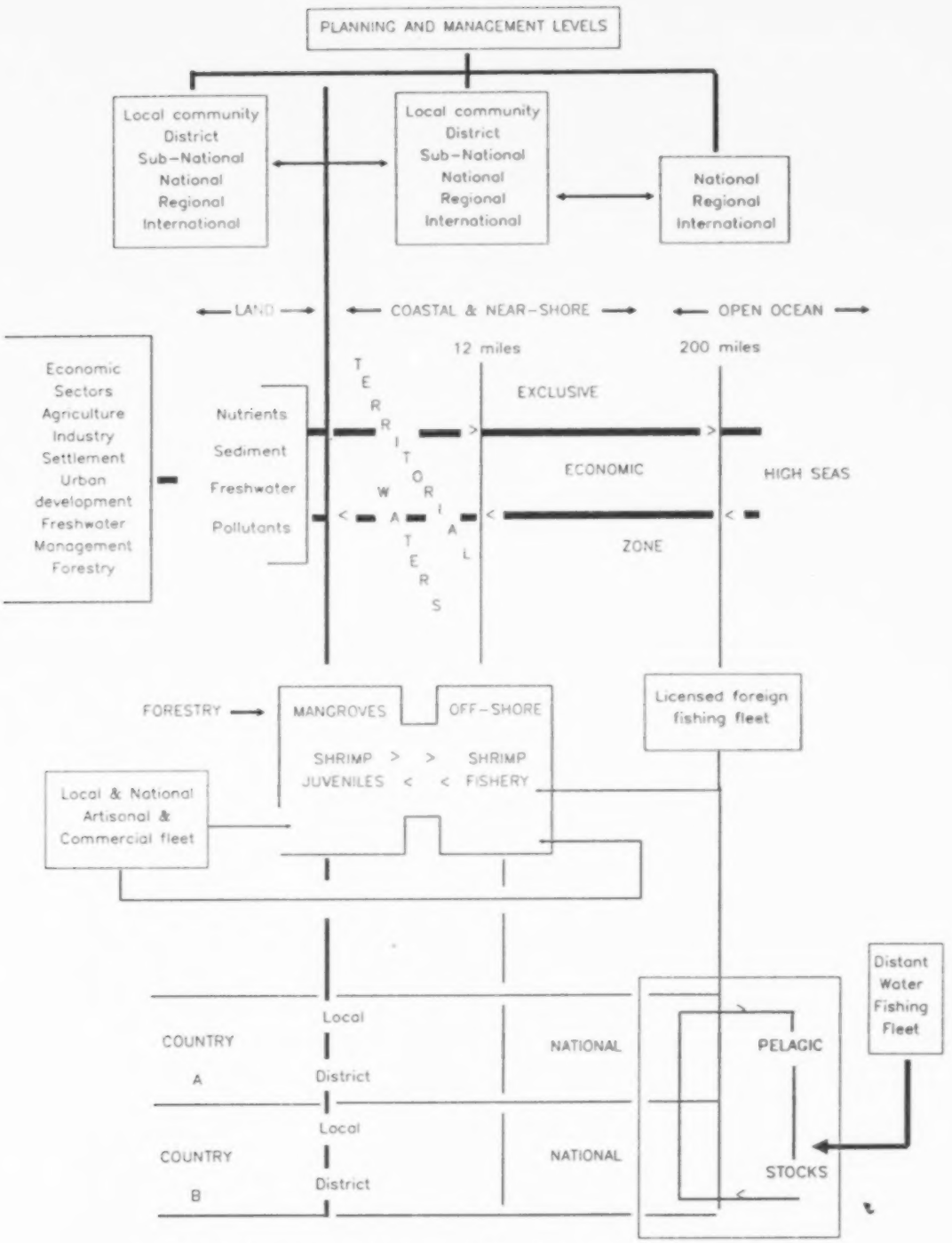

Table 1 Environmental and management boundaries, interests and conflicts

Table 2: Population Estimates: Cetacea

Species	Regional Population Totals	Range
Gray whale		
NE Pacific	21,113	(SE 688)
Minke whale		
NW Pacific	13,500	
NE Atlantic	ne	43,500-114,000)
Central Atlantic	28,000	(21,600-31,400)
W Greenland	3,266	(1,790-5,950)
Southern Ocean		
Area I (120W-60W)	73,302	(0.254 CV)
Area II (60W-0)	122,156	(0.190 CV)
Area III (0-70E)	88,735	(0.273 CV)
Area IV (70E-130E)	74,692	(0.257 CV)
Area V (130E-170W)	294,610	(0.138 CV)
Area VI (170W-120W)	106,901	(0.277 CV)
Bryde's whale		
NW Pacific	14,600-39,900	
SE Pacific	15,600	
Sei whale		
N Atlantic	>4,000	
N Pacific	9,110	
Southern Ocean	>12,000	
Fin whale		
N Pacific	16,625	(14,600-18,600)
Nova Scotia/Newfoundland/ Labrador	10,818	(5,387-21,723)
W Greenland	1,046	(520-2,106)
E Greenland/Iceland A	4,329	(2,312-8,107)
E Greenland/Iceland B	4,586	(3,519-5,976)
E Greenland/Iceland C&D	7,392	(3,334-16,390)
N Norway	1,476	(846-2,576)
W Norway	340	(85-1,355)
Faroes/Hebrides/Ireland	677	(345-1,328)
Iberia	4,617	(3,794-5,618)
Southern Ocean	85,200	
Blue whale		
N Atlantic	100-555	
S Indian Ocean	5,000	
Antarctic	450-1,900	
Humpback whale		
NW Atlantic	>5,505	(2,888-8,122)
N Pacific	<2,000	
Southern Ocean	>3,000	

Species	Regional Population Totals	Range
Right whale		
NW Atlantic	350	
SE Atlantic	>265	
SW Atlantic	/1,200	
N Pacific	200-400	
Southern Ocean	2,500	
Bowhead whale		
Davis St./Baffin Bay	>250	
W Arctic	7,800	(5,700-10,600)
Atlantic white-sided dolphin		
NW Atlantic	24,000	
Pacific white-sided dolphin		
NE Pacific	30,000-50,000	
Risso's dolphin		
NW Atlantic	10,000	
Bottlenose dolphin		
NW Atlantic	14,000-23,000	
Spinner dolphin		
NE Pacific	900,000	
Spotted dolphin		
NE Pacific	2.2 million	
Striped dolphin		
NE Pacific	2.3 million	
Common dolphin		
NW Atlantic	31,000	
NE Pacific	900,000	
Harbor porpoise		
NW Atlantic	18,000	

Species	Regional Population Totals	Range
Dall's porpoise		
N Pacific	2,15 million	
Beluga		
Arctic Circumpolar	62,000-88,000	
Narwhal		
Arctic Circumpolar	30,000	
Hector's dolphin	3,000-4,000	
Sperm whale		
Atlantic	190,000	
Pacific	930,000	
Southern Ocean	780,000	

Source: U.S. Marine Mammal Protection Act- 1989 Annual Report, NMFS, International Whaling Commission.

Table 3: Population Estimates: Pinnipedia

Species	Regional Population Totals
Pinnipeds	
California sea lion	
NE Pacific	157,000
SE Pacific	20,000
Northern sea lion	
NW Pacific	3,000
NE Pacific	63,000
South American sea lion	
SE Pacific	228,000
SW Atlantic	45,000
Australian sea lion	2,000-3,000
Hooker's (New Zealand) sea lion	6,000
Northern (Alaska) fur seal	
NW Pacific	332,000
NE Pacific	819,000
Juan Fernandez fur seal	
SE Pacific	705-750
Guadalupe fur seal	
NE Pacific	1,600
Galapagos fur seal	
SE Pacific	1,000-5,000
South American fur seal	
SE Pacific	294,000
SW Atlantic	52,000
South Africa (Cape)/Australian fur seal	
E Atlantic	850,000
Southern Ocean	20,000
New Zealand fur seal	
New Zealand	25,000
Sub Antarctic	33,000

Species	Regional Population Totals
Antarctic (Kerguelen) fur seal	
Sub Antarctic	1,52 million
Antarctic	10,000
Subantarctic fur seal	270,000
Largha seal	
NW Pacific	135,000-200,000
NE Pacific	200,000-250,000
Harbor (Common) seal	
NW Pacific	10,000-15,000
NE Pacific	302,000
NW Atlantic	30,000-45,000
NE Atlantic	48,000-51,500
Ringed seal	
Artic Circumpolar	6-7 million
Baikal seal	
Asia	40,000-50,000
Caspian seal	
Asia	500,000-600,000
Harp seal	
NW Atlantic	1.05 million-2.1 million
NE Atlantic	600,000-1,15 million
Ribbon seal	
Arctic Circumpolar	200,000-250,000
Gray seal	
NW Atlantic	24,000-55,000
NE Atlantic	77,000-78,500
Bearded seal	
NW Pacific	>500,000
Hooded seal	
NE Atlantic	500,000-600,000
Mediterranean monkseal	500
Caribbean monkseal	extinct/near extinct
Hawaiian monkseal	500-1,500

Species	Regional Population Totals
Southern elephant seal	
SW Atlantic	7,000
Sub Antarctic	38,000
Antarctic	148,000
Northern elephant seal	
NE Pacific	100,000
Crabeater seal	
Antarctic	15 million
Ross seal	
Antarctic	220,000
Leopard seal	
Antarctic	500,000
Weddell seal	
Antarctic	750,000

Source: U.S. Marine Mammal Protection Act 1989 - Annual Report.

Table 4. Assessments of three groups of whales: gray whales in the eastern North Pacific and Minke whales in the southern hemisphere and North Atlantic

GRAY WHALES		Population Size (1987/88)	
Eastern North Pacific		21,113 SE688	

Assuming a constant rate of increase, the population was increasing at a rate of 3.2% (SE 0.5%) over the period 1967/68 -1987/88 with an average annual catch of 174 whales.

MINKE WHALES	Year	Population Size	CV
Southern Hemisphere			
Area I (120oW-60oW)	1982/83	73,302	0.254
Area II (60oW-0o)	1986/87	122,156	0.190
Area III (0o-70oE)	1987/88	88,735	0.273
Area IV (70oE-130oE)	1988/89	74,692	0.257
Area V (130oE-170oW)	1985/86	294,610	0.138
Area VI (170oW-120oW)	1983/84	106,901	0.277
North Atlantic	95% confidence interval		
Northeastern stock		43,500-114,000	
Central stock	28,000	21,600-31,400	
West Green land stock	3,266	1,790- 5,950	

Estimates for areas other than the existing management stock areas are:

Central Plus West Greenland	31,200	24,450-37,950	
Central stock excluding area around Jan Mayen	22,400		
Northeastern stock excluding southern part		30,200-79,200	

BOWHEAD WHALES	Year	Population Size	CI
Bering-Chukchi-Beaufort Seas Stock	1988	7,800	5,700-10,600
HUMPBACK WHALES			
Western North Atlantic	1979-86	5,505-+2,617	

A rate of population increase of 10.3% (95% CI 2-23%) was obtained from the Gulf of Maine.

Source: International Whaling Commission, Communication from Dr. Ray Gambell (February, 1991).